PUBLIC WORKS

April
1959

CITY, COUNTY AND STATE

22 Years of Profit With
SEWAGE GAS ENGINES
page 101

Effective Control of
ODORS and INSECTS
in a Landfill Operation
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County Organization for
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STORM DRAINS
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How Land Uses Affect
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Double Seal Coating
With An
EQUIPMENT TRAIN
page 125

AND MANY OTHER
VALUABLE ARTICLES
SEE PAGE 5

Mark D. Hollis, Assistant Surgeon General of the Public Health Service and its Chief Engineer, has a solid background in public health engineering and administration. More data on page 18.

Four-inch F&P magnetic flowmeter measuring influent from the grinder at the Gainesway Subdivision Sewage Treatment Plant, Lexington, Kentucky. Accuracy is unaffected by piping configurations or valve placement. Consulting engineer: Marion C. Welch, Lexington, Kentucky.

F & P OBSTRUCTIONLESS FLOWMETERS GROW WITH THE PLANT

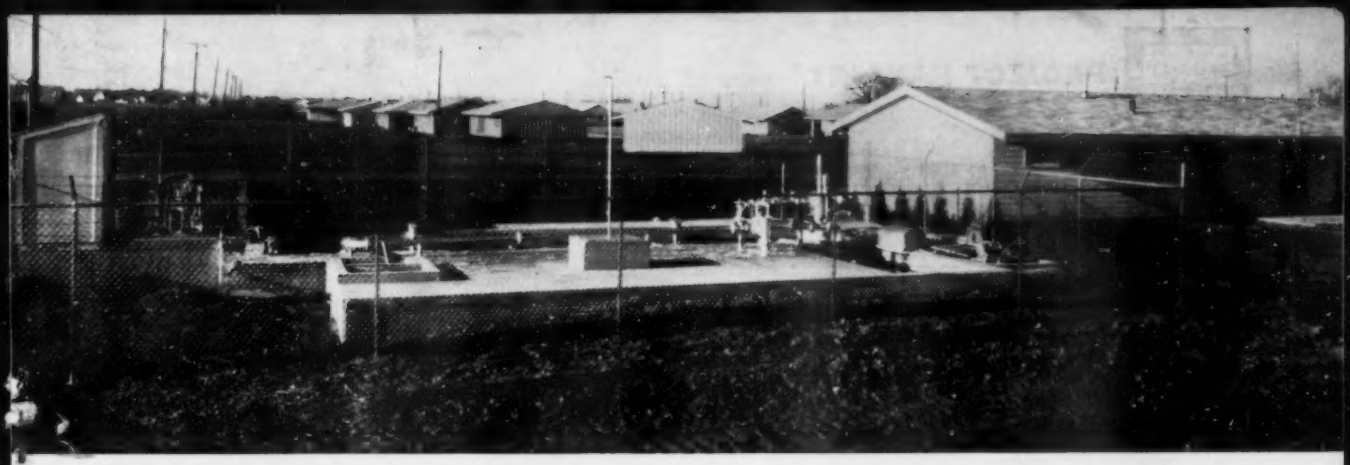
OBSTRUCTIONLESS . . . that's the big reason why more waste treatment plants are installing F&P magnetic flowmeters every day. No restrictions . . . no obstructions mean no clean-out problems whether you're metering raw sewage, effluent, or sludges. F&P magnetic flowmeters are even provided with built-in brushes for cleaning electrodes in a matter of minutes without shutdown.

But obstructionless isn't the *only* reason by a long shot. A special feature permits F&P magnetic flowmeters to *grow with the installation* . . . from start-up to maximum design capacity. All F&P secondary instruments are equipped with a *unique* in-case adjustment that permits any flow velocity from 1-30 fps to be set at *full scale*. Furthermore, *any* F&P magnetic meter can be used with *any* F&P secondary instrument without custom matching. Accuracy is independent of viscosity, density, or turbulence . . . unaffected by piping configurations or valve placement. You have complete freedom of plant design.

Available in sizes from $\frac{1}{2}$" to 72" diameter, the meters can be installed in any attitude and will measure full pipe flow in either direction without accessories. Don't overlook the fact that wide rangeability and high accuracy make these meters a natural choice for billing or "cash-register" applications.

Get the facts on Fischer & Porter magnetic flowmeters NOW! Contact the F&P field engineer nearest you, or write for Catalog 10D1416. Fischer & Porter Company, 549 Fischer Road, Hatboro, Pa. In Canada, Fischer & Porter (Canada) Ltd., 2700 Jane Street, Toronto, Ontario.

FP FISCHER & PORTER COMPANY *INSTRUMENTATION AND CHLORINATION*



SUBDIVISIONS
Gorman View Subdivision, Perrysburg, Ohio
Design Flow—30,000 G.P.D.
Approx. Plant Area—40 x 60 Feet

"from Chicago" RATED AERATION*

*a trademark of Chicago Pump Company

Small Unit Sewage Treatment Process Equipment for 20 to 5,000 People

SCHOOLS
Kennedy School, Louisville, Kentucky
Design Flow—7,500 G.P.D.
Approx. Plant Area—20 x 30 Feet

SHOPPING CENTERS
Westgate Shopping Center, Lima, Ohio
Design Flow—15,000 G.P.D.
Approx. Plant Area—30 x 30 Feet

MUNICIPALITIES
Valley Springs, California
Design Flow—40,000 G.P.D.
Approx. Plant Area—30 x 45 Feet

INDUSTRY
B. F. Goodrich Co., Oaks, Pennsylvania
Design Flow—56,000 G.P.D.
Approx. Plant Area—35 x 55 Feet

CONVENTS
Ancilla Domini-Villa Maria—Donaldson, Indiana • Design Flow—40,000 G.P.D.
Approx. Plant Area—30 x 45 Feet

HOSPITALS
Tuberculosis Hospital, Lima, Ohio
Design Flow—20,000 G.P.D.
Approx. Plant Area—26 x 28 Feet

Features

- Odor free
- Nuisance free
- Lowest cost sewage treatment
  - Low original cost
  - Low cost sewer lines . . . plant located within subdivision
  - Low operating and maintenance costs
  - Economically expendable . . . for area planning of future sewage systems
  - Small, compact plant area
  - Centralization means more homes per acre
- Expandable—by multiple units
- Exclusively successful standardized balanced equipment
- Applicable in steel or concrete units

For

Subdivisions	Dairies
Schools	Motels
Industry	Hotels
Military Installations	Trailer Courts
Hospitals	Airports
Municipalities	Camps
Convents	Country Clubs
Shopping Centers	Resorts

Equipment Application Information Available To Your Engineer From Chicago Pump Company Distributors Located In Most Principal Cities.

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Putting Ideas to Work

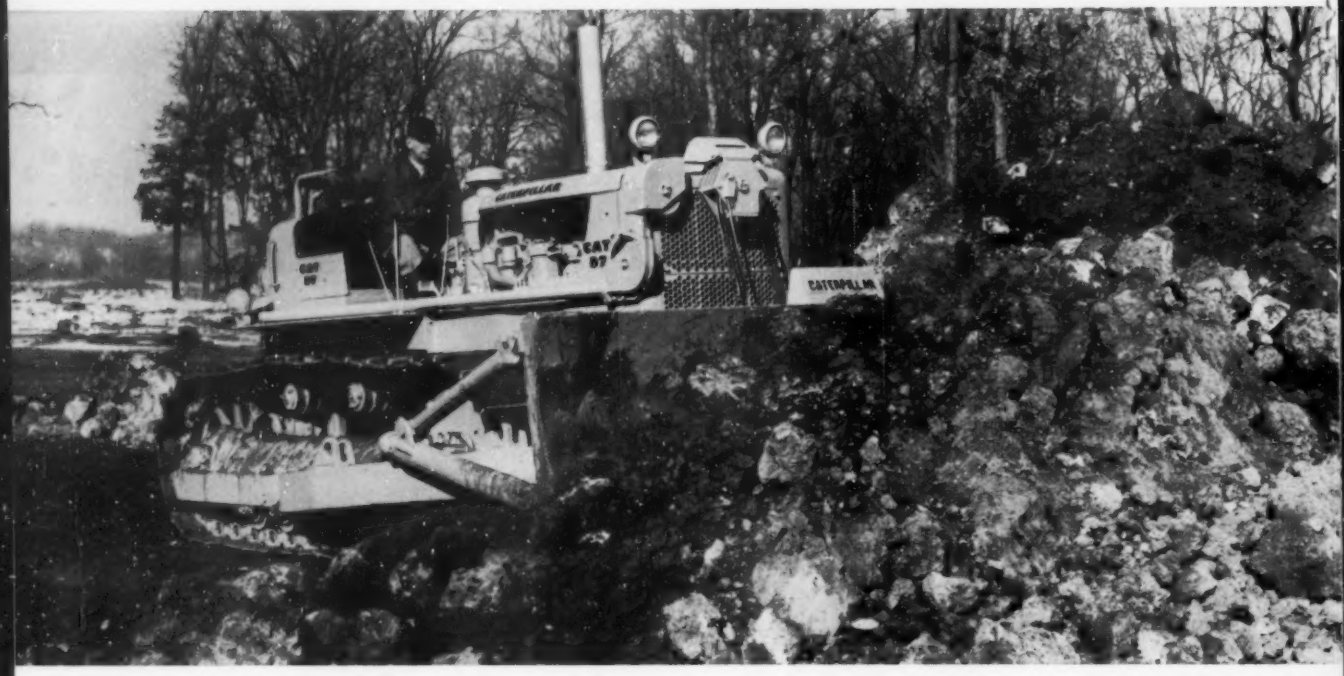
Over 300 Plants Installed 1955-1958

FOOD MACHINERY AND CHEMICAL CORPORATION
Chicago Pump Company
622F DIVERSEY PARKWAY • CHICAGO 14, ILLINOIS

PROJECT PAYDIRT* *pays off again*

NEW CAT D7 SERIES D TRACTOR

For higher production at lower operating cost



BY ANY comparison the new Cat D7 Series D Tractor is champ in its class. It packs 140 horsepower . . . matched with 80% more lugging ability than the previous model—for greater production. And it delivers this production at lower operating and maintenance costs. The payoff for you . . . increased performance that no other tractor in this power range can match.

Major improvements, developed by Caterpillar's Project Paydirt, affect the engine, power train and undercarriage. And the new Series D retains the exclusive Caterpillar Oil Clutch. It's time-tested; delivers up to 2,000 hours—one whole season—without adjustment.

For complete facts about the leader, see your Caterpillar Dealer. He's ready to give you the whole story on the new D7 Series D. And he'll arrange a demonstration on your job.

Caterpillar Tractor Co., Peoria, Illinois, U. S. A.

* ***PROJECT PAYDIRT:*** Caterpillar's multi-million-dollar research and development program — to meet the continuing challenge of the greatest construction era in history with the most productive machines ever developed.

NEW ON THE D7 SERIES D

TURBOCHARGED ENGINE features 9% horsepower increase, 80% more tractor lugging ability. Optional in-seat starting is available. The payoff . . . more production!

DRY-TYPE AIR CLEANER removes at least 99.8% of all dirt and dust from engine intake air during every hour. Cleaner can be easily serviced in 5 minutes. Filter element can be re-used. The payoff . . . economical, convenient maintenance and longer engine life.

SERVICE-FREE TRACK ROLLERS, carrier rollers and idlers are lifetime lubricated. New load-carrying design increases roller life. The payoff . . . longer life, no on-the-job lubrication shutdowns.

PRESSURE-LUBRICATED POWER TRAIN insures complete circulation of filtered oil to transmission, bevel gear and pinion. To transmit increased power, power train components have greater strength. The payoff . . . longer gear life, trouble-free operation.

CATERPILLAR

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BORN OF RESEARCH
PROVED IN THE FIELD

PUBLIC WORKS

THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

APRIL 1959 • VOLUME 90, NUMBER 4

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BPA

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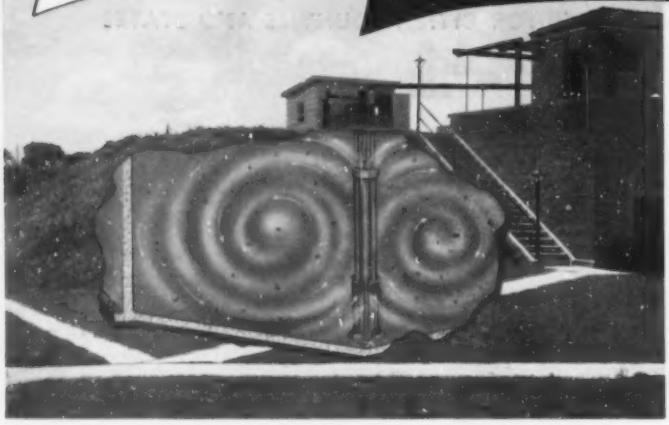
the process...
DIGESTER CIRCULATING-MIXING

the equipment... WALKER PROCESS
GASLIFTER

GASLIFTER UNIT



Above—Installation at Aurora Sanitary District, Aurora, Illinois serves to illustrate circulation and mixing action achieved with GASLIFTER. Published operating data attests to the resulting increased efficiency.

Walter A. Sperry.....Supt., Aurora Sanitary District
Walter E. Deuchler Co., Aurora.....Consulting Engineers

DIGESTER CIRCULATOR MIXER

INCREASED CAPACITY—GASLIFTER circulated digesters easily handle loadings of 6 lbs. of solids/cu. ft./mo.

BETTER DIGESTION— 15 to 20% more gas (methane) per lb. of volatile solids, together with low and uniform volatile acids—all accomplished in single stage digestion at high loading rates.

ELIMINATES SCUM BLANKETS AND GRIT SHOALS—Rapid circulation along roof, walls and bottom disperses grease blanket and prevents loss of capacity due to grit shoaling.

ADAPTABLE TO STANDARD OR HIGH RATE DIGESTION— The GASLIFTER may be applied to either standard or high rate digesters with equally efficient results.

ACCESSIBLE -specially designed locking chamber permits individual inspection and service of stainless GASLIFTER sparging units without dangerous gas loss or digester shutdown.

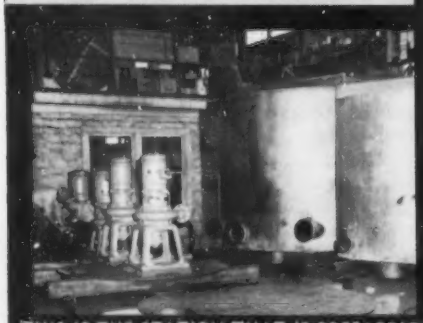
NO MECHANICAL SHUTDOWNS—GASLIFTER utilizes gas-lift principle and completely avoids mechanical troubles from rag and sewage "string" fouling. Sparjers used to diffuse gas in the eductor tube avoid all orifice troubles.

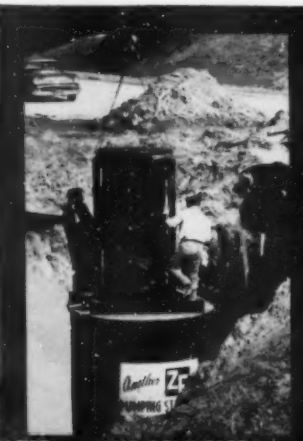
GASLIFTERS incorporate the patent rights of Joseph Cunetta
GASLIFTER is a trademark of Walker Process Equipment Inc.

WALKER PROCESS

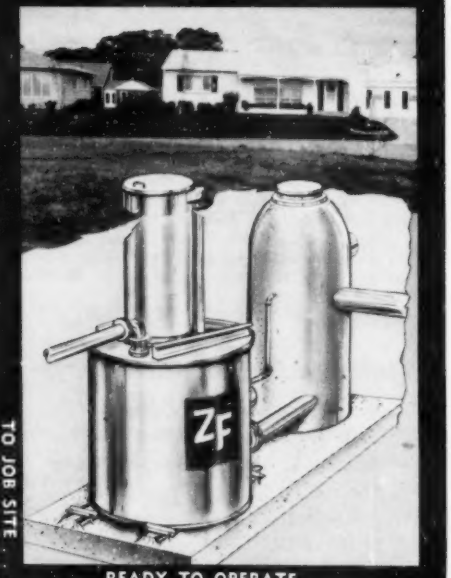
WALKER PROCESS EQUIPMENT, INC.
FACTORY • ENGINEERING OFFICES
LABORATORIES
AURORA, ILLINOIS

ZF PREFABRICATED PUMPING STATIONS





THIS IS THE STATION THAT IS PREFABRICATED . . . AND DELIVERED TO JOB SITE



READY TO OPERATE

A PACKAGED UNIT—completely shop-fitted with quality components throughout. Transported to job site ready for installation.

SIMPLIFIES LOCATION—underground operation permits use of existing public property such as parkways, etc. Saves cost of surface property and enclosing structure.

ECONOMICAL—saves costs and time. Prefabrication results in lower construction costs and less time at job site. Simply set in place, connect and start up.

COMPLETE DATA, SPECIFICATIONS AND DRAWINGS AVAILABLE—WRITE

ZF ZIMMER & FRANCESCON P.O. BOX 359, MOLINE, ILLINOIS

THE EDITOR'S POINT OF VIEW

Making Our Highway System More Effective and Safer

HIGHWAY FATALITIES during 1958 were the smallest in years—something like 37,000. About half of these deaths occurred during the hours of darkness when traffic is normally only about half as heavy as it is in the daytime. It has been proved that adequate street and highway lighting can markedly reduce the number of night-time accidents, and at a very low cost. In fact it has been estimated that all spots of appreciable traffic hazard on the Interstate system can be lighted for about one percent of the total cost of the road; it cost less than this on the Connecticut Turnpike. Adequate lighting could be one of our best investments in highway safety.

Public Education and Public Works Problems

FOR BETTER or for worse, we suspect our citizens know more these days about the moon and interplanetary space problems than they do about water supply and waste disposal. They pay for both, but more for water and sewerage services and these certainly affect their daily lives a great deal more closely. Perhaps the problems of moon travel are inherently of greater interest to the earth-bound citizen, but the present popular knowledge regarding space is a lesson in public education. We can think of many blessings that would accrue to water and sewage works managers if their customers were as educated in regard to these essential public works problems, and as interested in them.

Improving Water Works Personnel and Facilities

A LONG-NEEDED program has been launched by the American Water Works Association to improve the skills and abilities of water works managers and to foster the construction of more adequate water works facilities. An essential part in the success of this program will be contributions that the water works managers themselves can make. The AWWA can do a great deal, and will do it effectively; state sanitary engineering staffs can contribute through their close relationships with water departments and their personnel; but on the final analysis, local water works men can and must do a great deal for themselves. No outsider can come in and lift the local boots to an elevation higher than local opinion has placed them.

What is necessary locally is an ability to evaluate the needs for a reasonable time in the future; to advise local government of these needs sufficiently ahead of time to permit proper planning; to maintain such records as will facilitate sound planning; and to insure that through public relations the taxpayers are kept fully informed of actual conditions.

The policy of just getting by for another year has brought trouble to many communities, and it ought to be a thing of the past.

Ethics and Professional Status

THE MEMBERSHIP of the Texas Water and Sewage Works Association adopted a code of ethics at its annual meeting in March. In pledging adherence to the code, the member is committed to rendering adequate service to the public with due regard to protection of public health and property; encouraging the use of construction, operation and management procedures in the public interest; refusing remuneration, benefit or collateral employment conflicting with obligations to his job; engaging in only honorable competition for advancement; improving public respect for his office and services; and conducting himself as a loyal citizen. These tenets are not exactly new and to many individuals in the organization may seem repetitious of similar pledges in other organizations. However, this additional level of exposure can do an untold amount of good among the newly initiated members of the professions represented. The code prescribes not only behavior in good character, but emphasizes the qualifications that a man should have for such a job. This latter points up the Texas, or any like, association's most important reason for being—to improve the technical qualifications of its members. Ethical procedures and technical qualification go a long way toward lending professional status to the individual. The action is well taken and is another credit to this progressive organization.

This is The Year of the Boar

A GOODLY proportion of the outstanding sanitary engineers in the country are members of the Order of the Boar. One of our old-time Boars, Bill Weir of Georgia, reminds us (we didn't need reminding) that according to the Chinese calendar this is the year of the Boar; and further, according to the soothsayers, 1959 will be a "wing-ding" year. We hope so and we wish all of our fellow Boars all that a boar can crave.

EVERYWHERE in Sewage Treatment Plants

Evansville, Ind., Sewage Treatment Plant has two Climax V-85 and three Climax V-80 eight cylinder engines driving the sewage pumps.

CLIMAX ENGINES POWER the PUMPS

● Driving the Evansville, Indiana, sewage treatment plant's Worthington vertical sewage pumps through right angle gears at 720 rpm, 70 lb. BMEP, are five Climax eight-cylinder, 60-degree V-type sewage-natural gas engines. Two are 2474 cubic inch Climax V-85 model, 7⅛-in. bore x 7-in. stroke; and three are 2155 cubic inch Climax V-80 model, 7-in. bore x 7-in. stroke. Equipment includes dual ignition, air starting, Viking pump, Sarco blender, oil bath air cleaner, Honan Crane oil purifier, Synchro-Start ALS control and automatic fuel switchover.

The unusual compactness of Climax V-8 design means more power packed into less space. Rugged too, for durability with dependability in continuous duty sewage plant service.

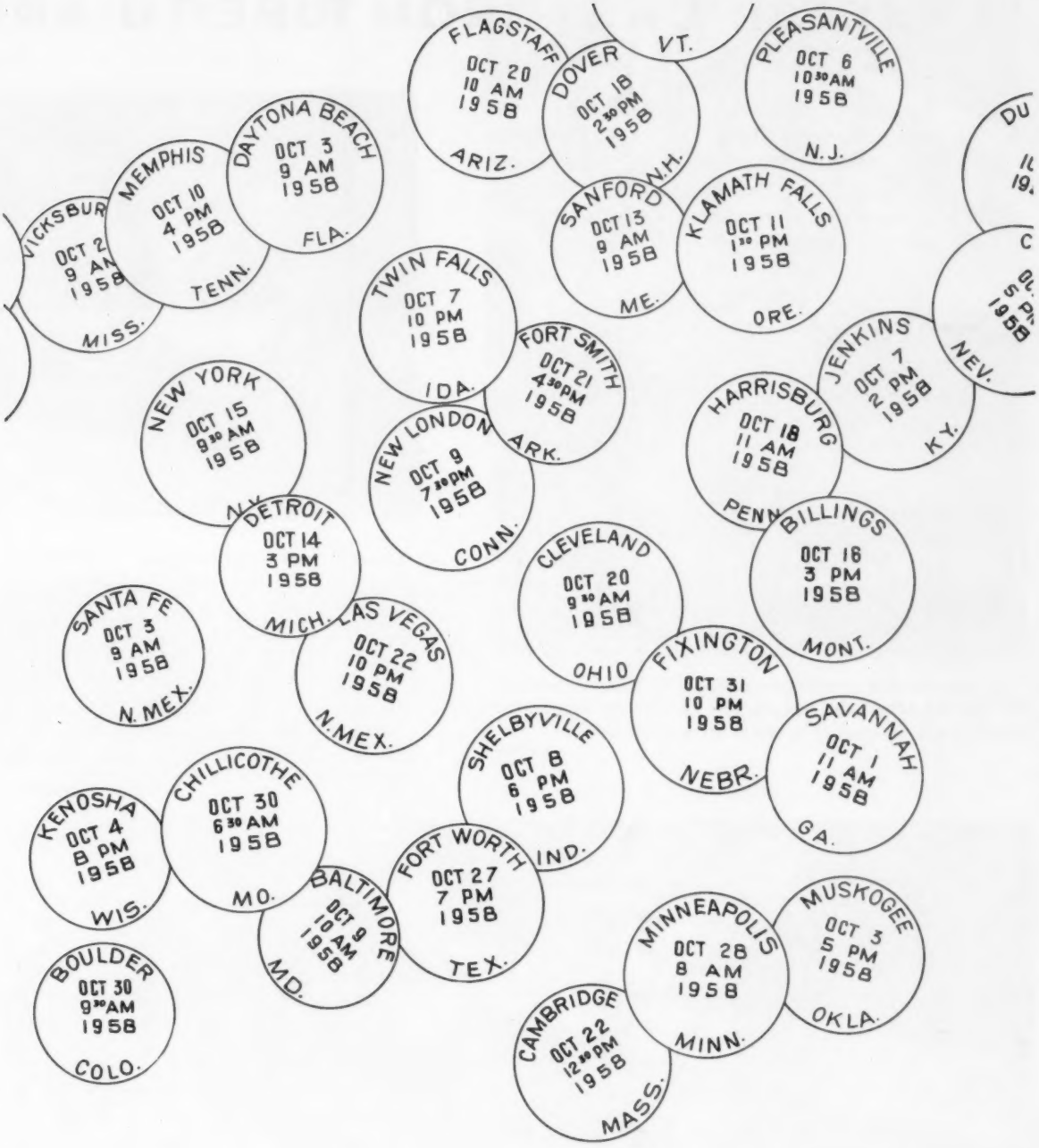
Fuel economy is built-in. All the Climax plus-value operational features are described in Bulletin SA-584—send for it.

CLIMAX ENGINE MANUFACTURING CO.

FACTORY—CLINTON, IOWA

DIVISION OF WAUKESHA MOTOR COMPANY

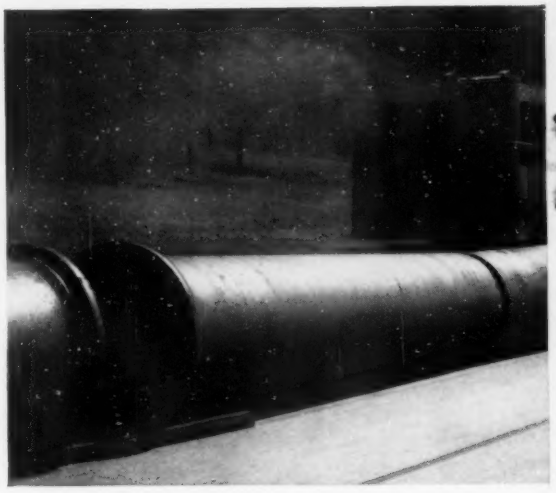
CL-102



From North, South, East and West, officials wrote in to say...

"I PREFER CAST IRON PIPE TO ANY

Recently a questionnaire was mailed to water utility managers all over the U.S.A. One question asked was: *What kind of pipe do you prefer and why?* With 42 states heard from, the vote is overwhelmingly in favor of cast iron! Here are typical comments:



"Strength, resistance to corrosion . . . economical first cost, low maintenance and operating cost, good flow characteristics."

—North Carolina

"Our main system is entirely cast iron. It holds up good in 'hot' soil conditions and will not rust out. We are nearing the century mark on some of it, and it gives no trouble."

—Kansas

"Long life—strength—ease of tapping. We are located, as a city, over old mine workings, and subsidence of earth causes trouble on other pipe to a greater extent than on cast iron."

—Illinois

OTHER KIND"

"We have a very hilly city, pressures up to 170 p.s.i. Some of our mains are 90 years old. They were cast iron and are still giving good service."

—Iowa

"Having been used over a long period of time, it has proved its worth. Structurally safe. Easy to repair."

—California

So many good reasons . . .

- LONG LIFE. The cast iron pipe you install today will be performing economically a hundred years from now.
- HIGH CAPACITY FLOW. Cement-lined cast iron pipe will deliver the full-rated flow all through the years. No other pipe, size for size, can carry more water.
- CORROSION RESISTANCE. Long life proves it. Most water utilities are still using the first cast iron pipe they installed.
- GREAT BEAM STRENGTH. Cast iron pipe resists the effect of heavy traffic, shifting soils.
- TREMENDOUS LOAD RESISTANCE. 6" cast iron pipe (Class 150) withstands a load of nearly 9 tons per foot!
- PRESSURE-TIGHT JOINTS. You have a complete choice of leakproof, easy-to-assemble joints. You need a minimum of tools and work crew.
- EASE OF TAPPING. No tapping saddles needed. Takes threading best of all kinds of pipe.

. . . good reasons for you *to choose*

CAST IRON PIPE

Cast Iron Pipe Research Association, Thos. F. Wolfe, Managing Director, 3440 Prudential Plaza, Chicago 1, Ill.

formula for ending stream pollution!

TRICKLING FILTERS + TFFI UNDERDRAINS = CLEAN WATERS

Trickling Filters' 6 great advantages

Low initial cost, low operating cost and long-term maintenance costs. Overloads are no problem. Give top-notch effluent. Minimum of operating personnel required

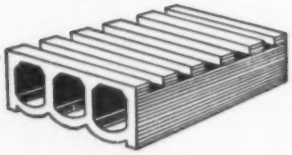
THE MOST IMPORTANT PART

Of a trickling filter is the underdrains. When built of vitrified clay to TFFI specifications they will safely carry highest hydraulic loadings. They alone can withstand all the ravages of acids, alkalis and bacterial action. They are made in modern plants under rigid controls of quality that are impossible with any substitute material. Only they offer you a 50-Year Guarantee against damage by acids and bacteria.

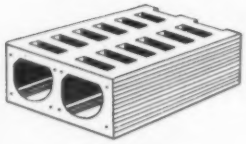
Leaders in ending stream pollution

TFFI members are proud of their part in providing clean waters for America through their contribution of superior vitrified clay filter floors. Over 35% of the population is now served by 2,682 sewage works with trickling filters. This number is constantly growing as more and more engineers discover their superiority.

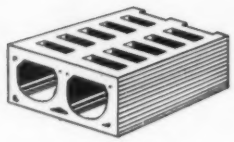
TFFI **TRICKLING FILTER**



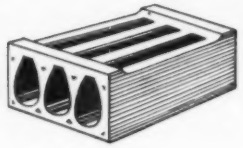
TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas



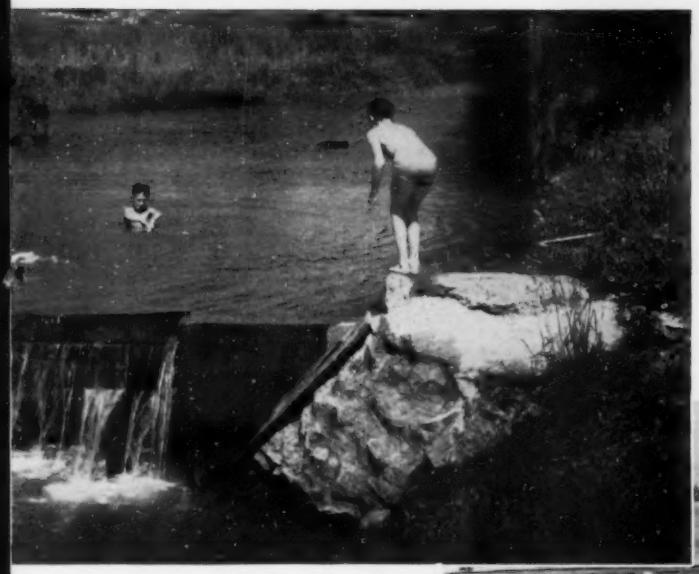
ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.

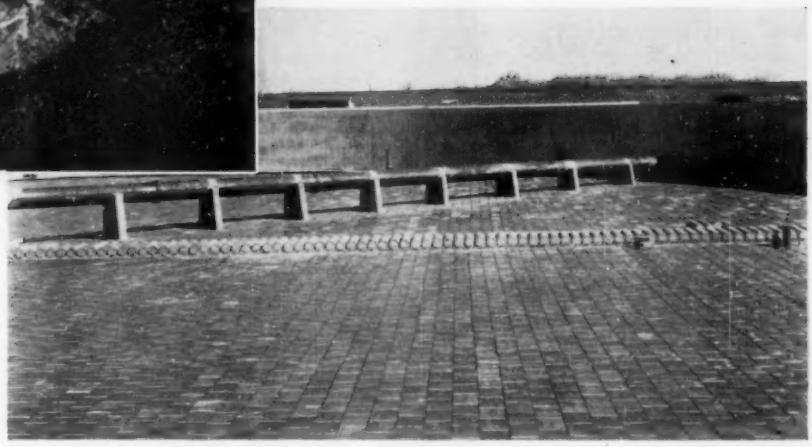


BOSCO
Bowerston Shale Co.
Bowerston, Ohio

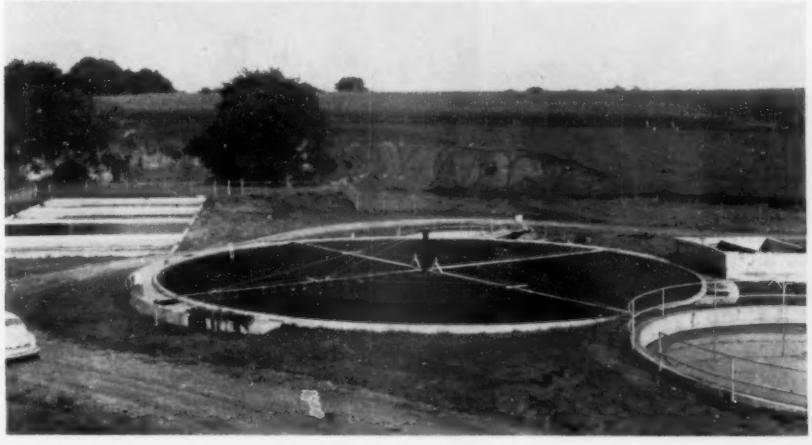


NATCO
Natco Corporation
Pittsburgh 22, Pa.





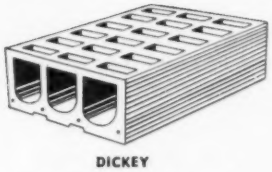
Trickling filter floor at Fort Worth, Texas • Consulting Engineers, Freese and Nichols, Fort Worth • Has major equipment by Infilco Inc. and Process Engineers, Inc.



Trickling filter at Knoxville, Iowa • Has TFFI Specification vitrified clay blocks • PFT rotary distributor shown.

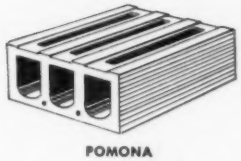
Address any member of the Institute for full details and suggested specifications for blocks.

FLOOR INSTITUTE



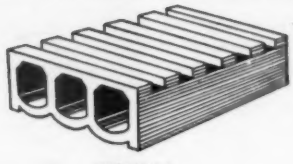
DICKEY

W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.



POMONA

Pomona Terra-Cotta Co.
Pomona, No. Car.



TRANSLOT

Cannelton Sewer Pipe Co.
Cannelton, Ind.

View from pump floor in Oswego, New York, pumping station showing one of main pumps being driven by Westinghouse 300-hp vertical synchronous motor above.

Robert B. Stannard, Resident Engineer for Nussbaumer, Clarke and Velzy, Consulting Engineers; Karr Parker, Jr., Buffalo Electric Co.; Kenneth D. Jensen, Superintendent, Department of Water, Oswego; and M. B. Trimble, Westinghouse Construction Sales Engineer, discuss "tilt-out, lock-out" feature of the control center. Westinghouse double-ended control power center has 300-kva Inerteen® transformer at each end.

Oswego water pumping station Powers-Up to attract new industries

The modernization and expansion program of the Department of Water, Oswego, N. Y., provides an interesting example of building today for tomorrow's needs. While planning for today, Oswego's Water Board recognized that a good water supply is an indispensable commodity in attracting new industry to the area. By Powering-Up electrically, their new pumping station has electrical capacity five times present demand to allow for future growth.

Present demands for water are approximately 10 million gallons per day. Installed pumping capacity is capable of providing more than 20 million gallons per day. In addition, provision has been made to increase capacity to 35 million gallons per day when required by future demands.

The new pumping station is supplied with lake water from an intake tunnel which extends through solid rock for a distance of 6250 feet into Lake Ontario. This tunnel intake averages eight feet in diameter and is capable of conveying 128 million gallons of water per day.

Electrical power for the station is available from two separate sources—one direct from the Oswego Steam Station and the other from the Niagara-Mohawk Varick Station. The complete electric distribution system, as furnished by Westinghouse, provides for all anticipated future expansion of the pumping station.

Powering-Up electrically for future growth can offer important advantages to you. For further information, call the Westinghouse electrical engineer nearest you, or write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania.

J-94119

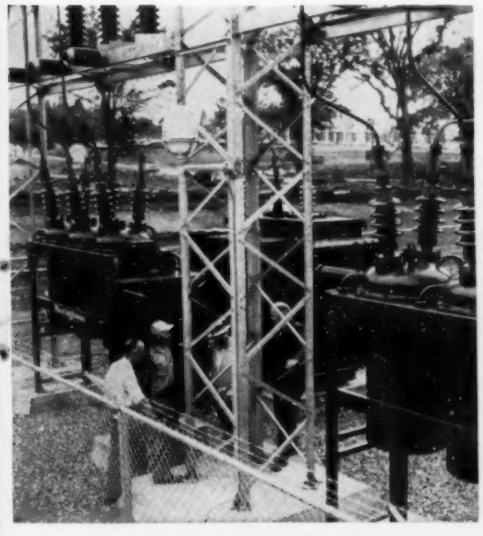
Owner: Department of Water, Oswego, N. Y.
Consulting Engineers:
Nussbaumer, Clarke and Velzy
General Contractor: McElwee-Courbis Const. Co.
Electrical Subcontractor: Snyder and Mackin, Inc.
Westinghouse Distributor: Buffalo Electric Co., Inc.

Over 250 Pages Westinghouse Data in Sweet's Construction File.

YOU CAN BE SURE...IF IT'S

Westinghouse

WATCH "WESTINGHOUSE LUCILLE BALL-DESI ARNAZ SHOWS" CBS TV MONDAYS



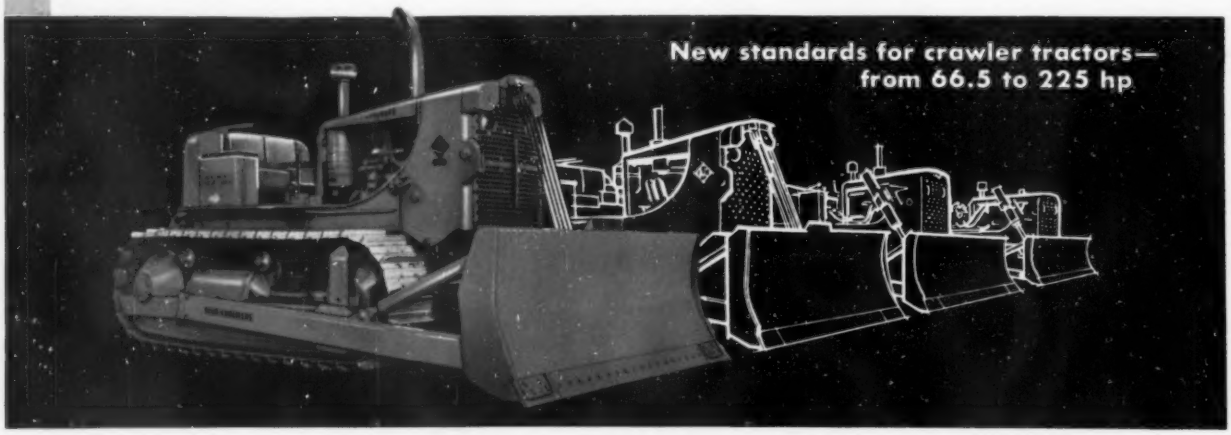
Leo J. Landrigan, Superintendent, Oswego Pumping Station; Richard C. Mansfield, Foreman for Snyder and Mackin, Electrical Contractors; Kenneth D. Jensen; and Charles T. Hansen, Westinghouse Sales Engineer, at outdoor substation which serves new Oswego pumping facility. Two Westinghouse 2000-kva power transformers and two Westinghouse 34.5-kv oil circuit breakers are included in this substation.

Main floor view in pumping station shows four Westinghouse vertical synchronous pump motors with the glass enclosed control room in background. The mezzanine floor above is occupied by Westinghouse 2300-v, heavy-duty, metal-clad switchgear, using Type DH air circuit breakers.

Another view of main floor shows reverse side of control room and, on the mezzanine, Westinghouse double-ended control power center. Floor openings in foreground, not shown, have been provided for the installation of four additional raw water pumping units when filter plant is added.

How to get more tractor for your dollar

Advantage	What it means to you
All-steel main frames	Power train protection Better equipment mounting Better weight distribution
Permanent lubrication of truck wheels, idlers and support rollers	No more wasted time greasing these track components
Torque converter drive	Matches power to load automatically Transmits power smoothly Less shifting
Double reduction final drives	More clearance Longer gear life
True unit construction	Faster service Easier access to all major assemblies



move ahead with ALLIS-CHALMERS.

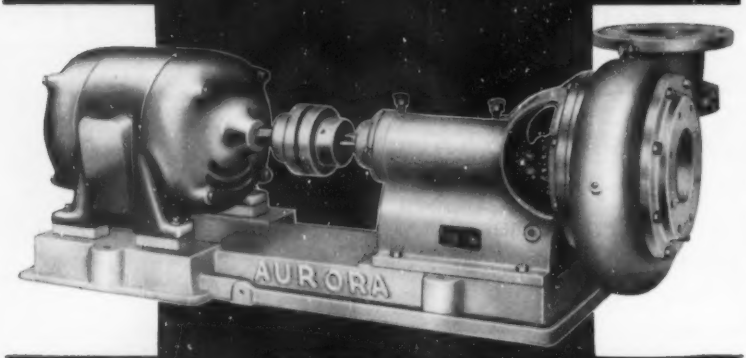
In the chart below are five important crawler tractor advantages. These features have earned recognition by all makers of crawler tractors—one or more are now included in their latest designs. It stands to reason that the more of them you get on your next crawler, the more it is worth to you.

Where you get it
Allis-Chalmers is the only manufacturer offering main frames in *all* models. Two other manufacturers now offer them in one model.
Allis-Chalmers is the only manufacturer offering permanent lubrication of truck wheels, idlers and support rollers on *all* models. One other manufacturer offers permanent lubrication on three models.
Allis-Chalmers pioneered it in crawler tractors in 1940 . . . offers it in two tractor shovel models, two tractor models. All other major manufacturers now offer it as optional equipment in one or more models.
Allis-Chalmers is the only manufacturer offering double reduction final drives on *all* models. One other manufacturer offers it on three models.
Allis-Chalmers is the only manufacturer offering true unit construction in *all* its models. Two other manufacturers now offer modified unit construction in part of their lines.

Here's proof that other manufacturers of crawler tractors have chosen to "follow the leader" with Allis-Chalmers engineering . . . and that your Allis-Chalmers dealer is the man to see for top value in crawler tractors. He'll be glad to demonstrate the model of your choice. It will have more industry-approved advantages than any other unit near its size. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

. . power for a growing world

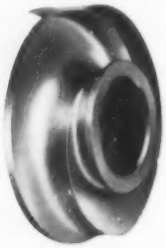
AURORA® CONTROLLED PERFORMANCE



MONO-VANE

NON-CLOG PUMPS

"The Pump with the single passage impeller"



MONO-VANE IMPELLER

- CAPACITIES TO 1000 G.P.M.
- HEADS TO 150 FT.
- BALANCED IMPELLER
- HORIZONTAL OR VERTICAL
- RUGGED CONSTRUCTION
- PROVEN DEPENDABILITY
- MINIMIZED WEAR
- FAST INSTALLATION
- EASY MAINTENANCE

The Mono-Vane impeller is in hydraulic and dynamic balance. It can be trimmed to suit various head and capacity requirements and still retain proper balance. The AURORA Non-Clog Pump is ideal for handling long stringy materials. Smooth, quiet operation is assured with the Mono-Vane impeller which is always in dynamic and hydraulic balance—even when trimmed to accommodate various head and capacity requirements. Single passage impeller design makes the AURORA Non-Clog pump ideal for handling long stringy materials. The discharge may be turned to any position to facilitate installation, service and maintenance. Clean-out cover is located in casing to provide easy service access.

Typical applications: elevating sewage, pumping sludge, handling heavy settleable solids, effluent, and other wastes and industrial by-products.

WRITE FOR BULLETIN 121 MV

AURORA Always PUMPS

AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY
630 LOUCKS STREET • AURORA • ILLINOIS

LOCAL DISTRIBUTOR IS LISTED IN THE YELLOW PAGES OF YOUR PHONE BOOK

Mark D. Hollis is Assistant Surgeon General and Chief Engineer of the U. S. Public Health Service. He has under his general charge such engineering operations as the Federal Water Pollution Control Program, Milk and Food Sanitation, the Community Air Pollution Activity, and the General Engineering Program of the Public Health Service. He entered the Public Health Service in 1931. Early assignments included shellfish sanitation, typhus fever control and stream pollution studies. After a year with the Rockefeller Foundation, he served as State Sanitary Engineer of North Dakota.

During the war years he served as executive officer of, and later directed, the war-related malaria-control operations of the Service. He was officer-in-charge of the PHS Communicable Disease Center in Atlanta, Georgia, and in 1947 was appointed executive officer to the Surgeon General in Washington. He was promoted to his present position of Assistant Surgeon General and Chief Engineer in January 1948.

He was born in Buena Vista, Ga., in 1908, and was graduated as a Civil Engineer from the University of Georgia in 1931. He is currently Vice President of the FSIWA, a member of the Board of Consultants of the National Sanitation Foundation and of the ASEIB. He is a Fellow of the APHA, past chairman of their Engineering and Sanitation Section and past president of the National Malaria Society. He is a member of ASCE, NSPE, the Conference of State Sanitary Engineers and the Conference of Federal Sanitary Engineers. He is U. S. Commissioner of the Potomac River Interstate Water Commission and was a member of the Expert Committee on Environmental Sanitation of WHO.

Mr. Hollis is married and has a son and daughter now in college. He is a Registered Professional Engineer. In 1952, he received an honorary Sc.D. from the University of Florida.

FILE REFERENCE

FACT SHEET

GRAVER®

Elevated Water Tank Solves Pressure Problem In Ashland, Ohio

Don T. Hostettler, Mayor
Melvin Bauer, City Engineer
Edward F. Petzke, Supt. of Water Works
Uhlmann Associates,
Consulting Engineers
Columbus, Ohio
H. E. Bonham, Project Engineer
Graver Tank & Mfg. Co.
Division—Union Tank Car Company
Design, Fabrication and Erection

Type: Double Ellipsoidal Elevated Tank
Capacity: 200,000 gallons
Height to Overflow: 129′ 11″
Head Range: 29′ 11″
Diameter of Tank: 36′ 0″
Built to AWWA Specifications

THE PROBLEM

The City of Ashland, Ohio, was growing—and it was literally growing uphill. For years Ashland's water needs had been served from a 2,000,000 gallon reservoir on a hillside above the town. Three years ago the city annexed 1,850 acres adjoining the County Fair Grounds, located well above the reservoir. The pumping station could not maintain adequate water pressure for the new residential development.

THE SOLUTION

Uhlmann Associates were selected by city officials as consulting engineers. They made a detailed study, giving special attention to the problem of adequate water pressure in all areas. They recommended construction of a 200,000 gallon elevated water tank on high land near the Fair Grounds as well as a new pumping station at the present reservoir.

Graver was selected to design, fabricate and erect the elevated water tank. Thus supplemented, the new Ashland water distribution system provides ample pressure in all areas and will meet not only the anticipated growth of the city but also the annual peak loads at the time of the County Fair.

Water storage and pressure problems are being solved regularly by villages and cities across the country with Graver's help. Graver's experience of over a hundred years with tank fabrication and erection contributes directly to the solution of these problems, through cooperation with the consulting engineers.

GRAVER TANK & MFG. CO.
DIVISION—UNION TANK CAR COMPANY
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Pittsburgh • Atlanta • Detroit • Chicago • Tulsa
Sand Springs, Oklahoma • Houston • New Orleans
Los Angeles • Fontana, California • San Francisco
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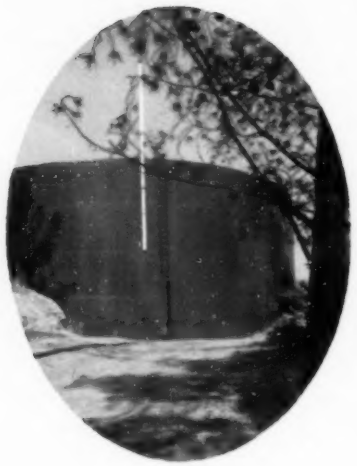
BUILDING FOR THE FUTURE ON A CENTURY OF CRAFTSMANSHIP IN STEELS AND ALLOYS

GRAVER®

DESIGNED, FABRICATED AND ERECTED BY



WHICH WILL BEST HANDLE YOUR WATER STORAGE?

Standpipe—like that above for Niskayuna, N. Y. or that at the lower right for Norwalk, Conn.? Reservoir—like that at the top right for Beverly Hills, Calif.? Elevated tank—like the one at the right, one of two for Joliet, Ill.? Or a pump suction tank? Graver is long experienced in fabricating and erecting tankage of all types for many purposes. The most suitable tankage for your water storage needs is provided in collaboration with your consulting engineers and water department officials.

GRAVER TANK & MFG. CO.
DIVISION—UNION TANK CAR COMPANY
EAST CHICAGO, IND.

GRAVER®

Plants and Offices Across America

New, Longer CLAY PIPE has ALL the features you can trust!

Because Vitrified Clay Pipe is the *only* chemically-inert pipe, it's the *only* pipe that's completely impervious to the corrosive attacks of sewerage acids and gases . . . never rusts, rots, corrodes, or disintegrates. Its smooth vitrified surface assures faster, freer flow . . . keeps the line operating at rated capacity. And now, new research-developed, factory-made compression joints reduce installation costs, stop infiltration, roots, and provide a tighter, longer-lasting seal. Don't settle for substitutes. *Only Clay Pipe has all the features you can trust.*

C-569-2

Vitrified **CLAY PIPE** *Never Wears Out*

NATIONAL CLAY PIPE MANUFACTURERS, INC. 1820 N Street, N. W., Washington 6, D.C.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio • 703 Ninth & Hill Bldg., Los Angeles 15, California • Box 172, Barrington, Illinois • 1401 Peachtree St., N. E., Atlanta 9, Georgia

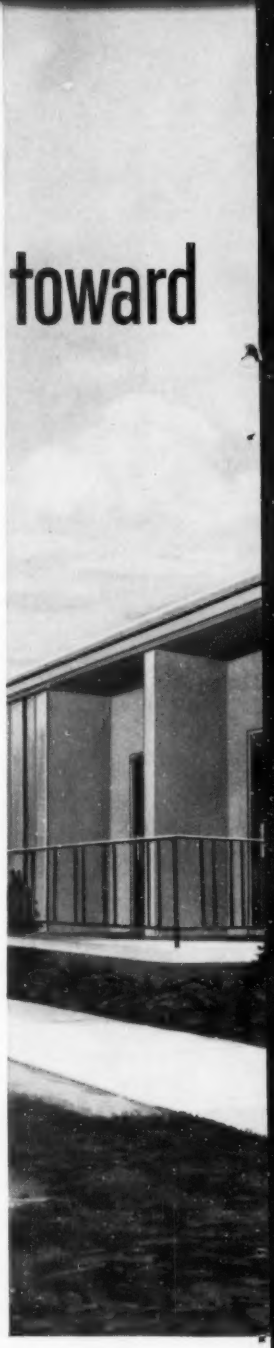
ANOTHER STRIDE BY BUTLER toward

Revolutionary new insulated curtain wall factory cut to fit Butler structurals

Someday soon, complete industrial and commercial buildings will be factory-fabricated, and assembled from standard parts on the site. The Butler system of pre-engineered buildings has already made rapid strides towards this goal.

Now Butler announces Monopanl®. . . a new factory-fabricated, factory-insulated wall panel. Monopanl creates the entire exterior wall, complete with decorative outer face, insulation and finished interior face. Each panel is factory-sized for precision fit on Butler structural systems. Monopanls are merely bolted in place. Your building is completed with incredible speed. The result – an attractive building that will compare in quality to the best traditional construction, yet will conserve your capital.

With new Monopanl, Butler now offers the most advanced pre-engineered . . . factory-fabricated system of building for commerce and industry. Get all the facts and learn about Butler financing from your nearest Butler Builder. He's listed in the Yellow Pages under "Buildings" or "Steel Buildings." Or write directly to us.



from a design by
A. Francik and
Associates, Architects

BUTLER®

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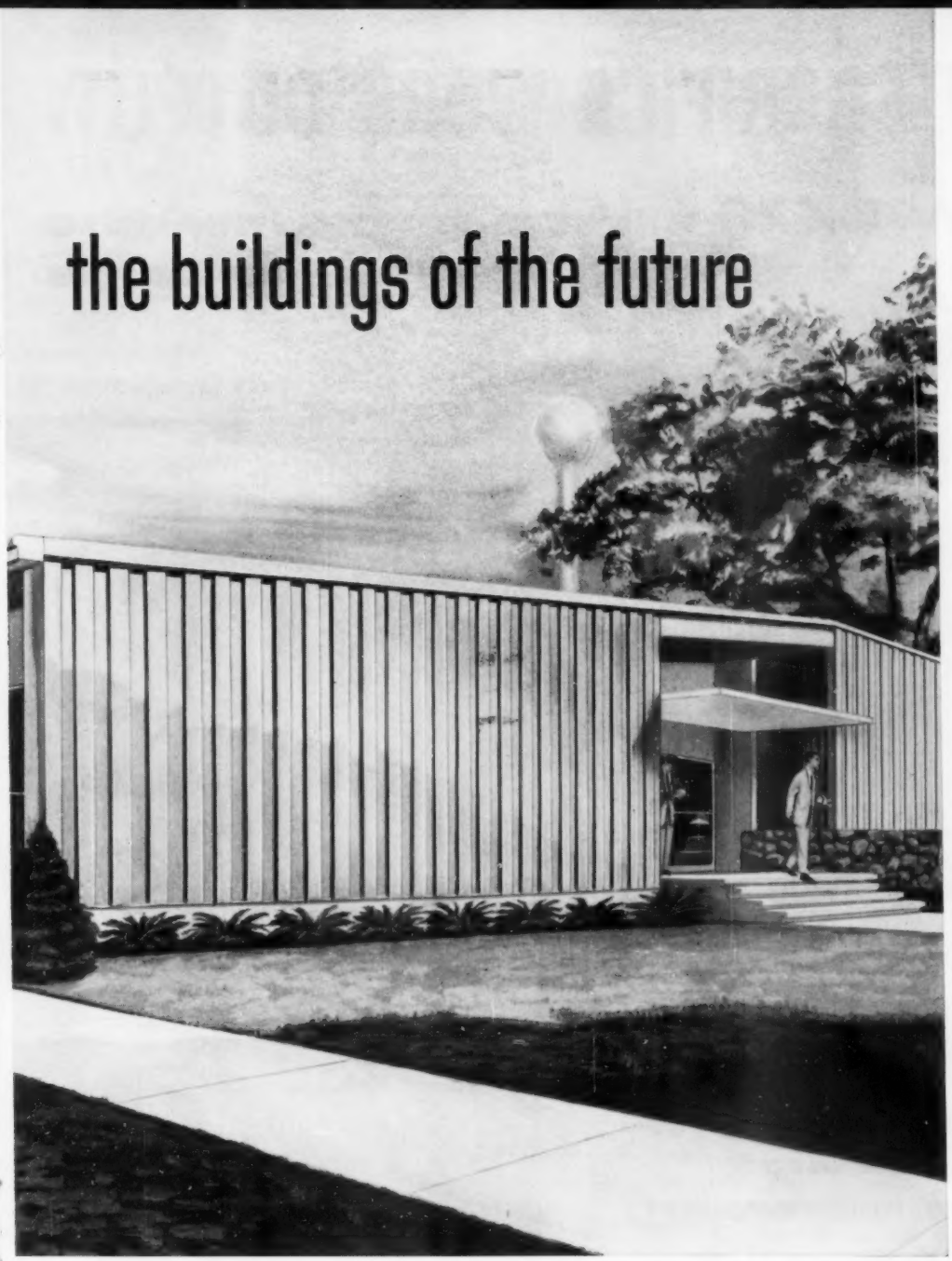
7321 East 13th Street, Kansas City 26, Missouri

Manufacturers of Metal Buildings • Equipment for Farming, Dry Cleaning, Oil Production and Transportation, Outdoor Advertising • Contract Manufacturing

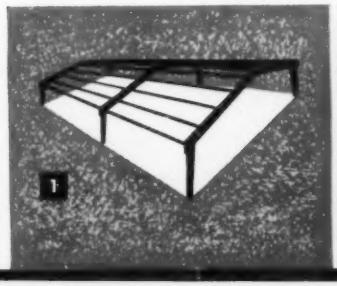
Sales offices in Los Angeles and Richmond, Calif. • Houston, Tex. • Birmingham, Ala. • Kansas City, Mo. • Minneapolis, Minn. • Chicago, Ill. • Detroit, Mich. • Cleveland, Ohio • Pittsburgh, Pa. • New York City and Syracuse, N. Y. • Boston, Mass. Washington, D.C. • Burlington, Ontario, Canada

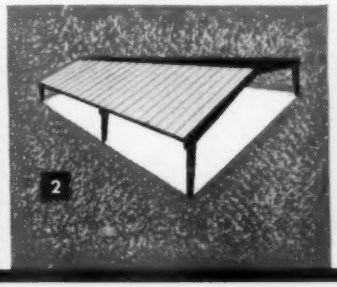
the buildings of the future

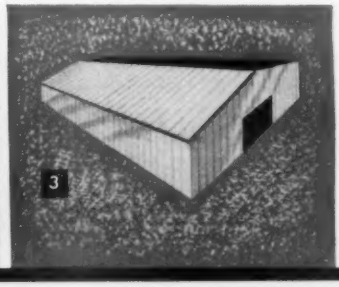


Now, more than ever, the fastest, lowest-cost way to build well

Butler pre-engineered components fit together so perfectly that construction is little more than an assembly job. 1. Butler structurals are bolted together and erected. 2. The Butlerib roof is attached. 3. Monopanl walls are installed by simply pushing together and fastening to the structurals top and bottom. Your building is completed and you're in business, earning profits weeks, even months sooner, than ordinary construction methods would have permitted.



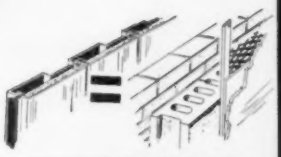




How Monopanl creates a superior wall

Each Monopanl is literally a metal plank with insulation between metal inner and outer faces. The complex configuration makes Monopanl the longest spanning . . . most rigid panel of its type.

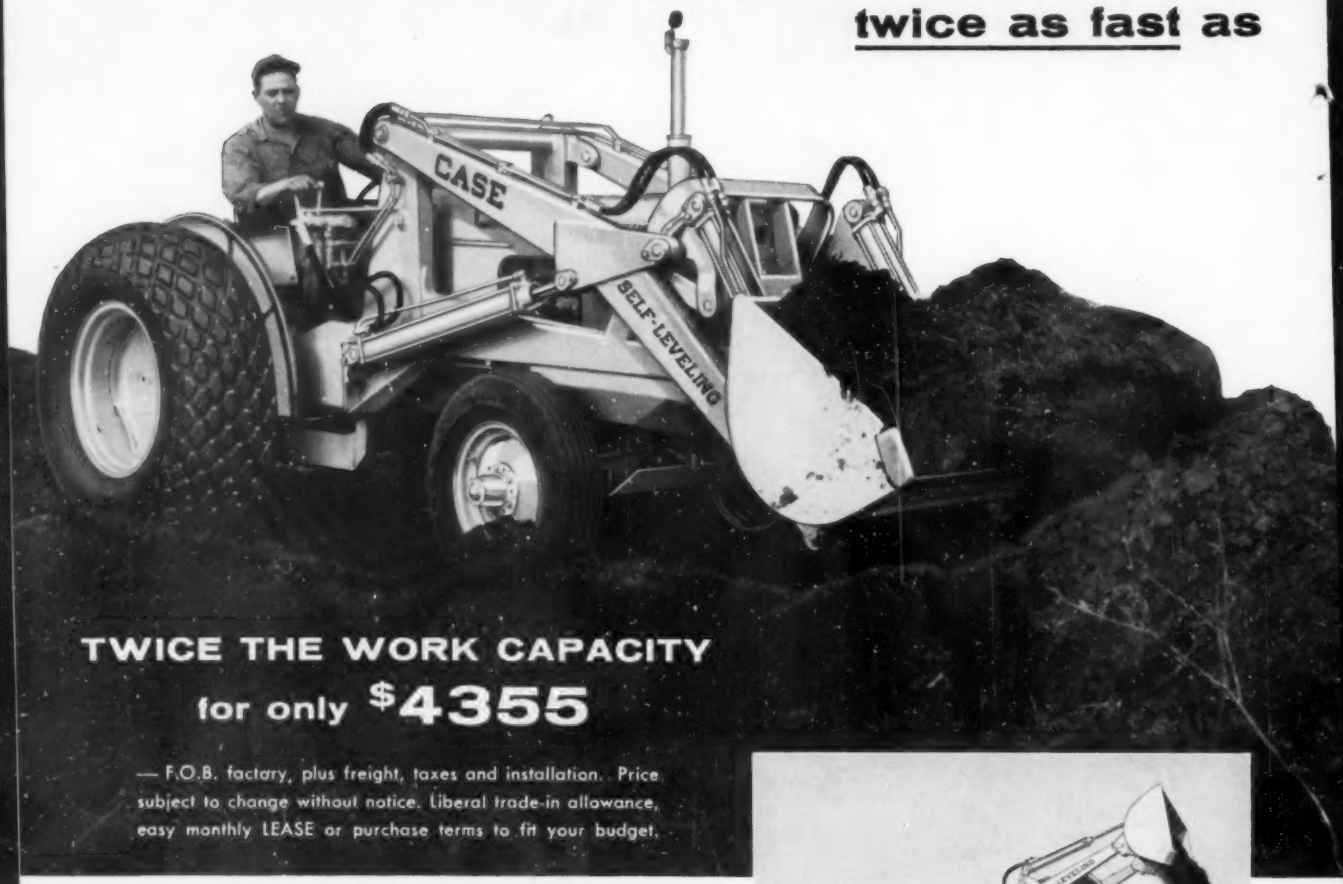
The unique double tongue and groove design creates a strong panel-to-panel joint. And double vinyl gaskets permanently seal out moisture, last the life of the building.



Monopanl is only 3 inches thick, yet is equal in insulating ability to a masonry wall of 4 inches of brick, 8 inches of concrete block, 1 inch of rigid insulation with air space and ½ inch of plaster.

WHY SACRIFICE WORK OUTPUT

. . . CASE 420 with torque-converter drive twice as fast as



TWICE THE WORK CAPACITY for only $4355

— F.O.B. factory, plus freight, taxes and installation. Price subject to change without notice. Liberal trade-in allowance, easy monthly LEASE or purchase terms to fit your budget.

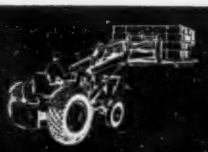
Torque power is matched to the load instantly, automatically!

No need to "ram" the pile or spin the wheels with a Case 420. You just "ease" bucket into ground or stockpile, step on accelerator, and let the torque converter do the rest. Instantly, automatically, it delivers *full torque* to fill the bucket quickly — without clutching, shifting or stalling. *Clutch wear is eliminated.* Engine overloading is avoided, jolting shocks absorbed, so entire machine lasts longer with less maintenance.

No clutching! No shifting! No stalling!

Quick-change attachments increase versatility, save hand labor!

Dozer Blade


Pallet Fork

Crane Boom

WITH A LIMITED-DUTY LOADER?

doubles digging power... gets full loads any clutch-type loader in its class

Why put money into *limited-duty* loaders that get only "thimble-size" loads, when you can handle a wider range of jobs at lower net cost, with a *bigger capacity* Case 420? Exclusive torque-converter drive *doubles* the digging power and traction of the "420" ... maintains full break-out power at all times. Result: you get *heaped loads twice as fast* as any conventional clutch-type loader in a similar price range. With up to 12,000 lbs. pull, you can drive a fully-loaded "420" through soft spots, or up grades, that would stall other wheel-type rigs. Yet you can *switch to direct drive with the flip of a lever, for fast road travel.* Your nearby Case Industrial Dealer will gladly demonstrate the torque-converter-equipped Case 420 loader, or backhoe-loader combination anytime — without obligation. Just mail the coupon.

More reasons why your dollars buy more in a Case 420

Bigger Payload Capacity — Husky 15-cu. ft. self-leveling loader bucket (21 cu. ft. optional) handles heaped payloads *without spillage*... has extra-high 9' dump clearance, with exclusive "knock-out" action for fast, clean dumping into high-sided trucks.

Faster Back-up... Easier Steering — Exclusive Case synchronized shuttle transmission (STANDARD) simplifies back-and-forth shifting, lets you *back-up 24% faster than forward* in each gear. One-finger power-steering (STANDARD) gives 90% power-assist, yet holds positive course in rutted ground.

Greatest Break-out in its Class — Bigger 21 GPM hydraulic pump . . . larger 3" lift cylinders . . . 25° bucket roll-back... produce powerful pry-out action that *never falters or fades due to engine overload.*

Faster Operating Speeds — Eight road speeds (up to 19.3 mph forward, 24 mph reverse) in DIRECT DRIVE — plus an infinite number of working speeds in TORQUE-CONVERTER DRIVE — insure highest possible output per hour, per day, per gallon of fuel.

Case 420 Backhoe-Loader

gives you the extra power benefits of torque-converter drive for loading and backfilling, *plus* 12½' digging depth, 180° foot-controlled swing and many other production-boosting features for backhoe operation.

Mower

Blade
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Clip... Mail for full details

J. I. CASE CO., Dept. D1349, Racine, Wis.

☐ Send free catalog on Case 420 loader
☐ Have nearest dealer representative call

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Company .....

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City ..... State.....

C-L-276

PRIMITIVE WASHDAY...Washing in a river —inefficient and exhausting—is still done in many undeveloped countries. Clothes never really come clean and are often contaminated.

THE MODERN WOMAN merely turns a switch...her wash is done automatically in clear, pure water – most of it carried through cast iron pipe.

U.S. cast iron **PIPE**

FOR WATER, SEWERAGE AND
U. S. PIPE AND FOUNDRY COMPANY

but better than ever today!

From mine-to-line, U. S. Pipe controls quality

America's water systems... finest on earth... didn't just happen.

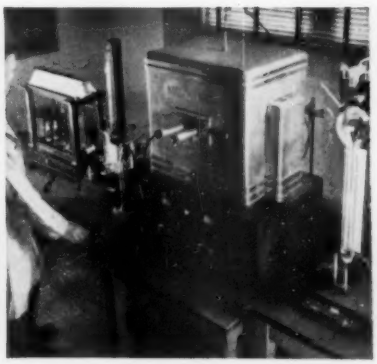
They are made possible by forward-looking water officials and the dependable cast iron pipe that carries most of the nation's water.

We supply much of that pipe. To make sure it's as good as human care, skill and integrity can make it, U. S. Pipe controls every production step. From mining of ore to modern packaging, our pipe is tested, checked and rechecked for quality every step of the way.

Dependability is built into U. S. Pipe... literally, from the ground up!

PROBING THE EARTH... Our own iron ore is mined from deposits as much as two miles distant from the portal.

INSPECTING HOT PIPE... U. S. Pipe, just removed from the mold, is checked and inspected for quality.



SCIENTIFIC TESTING... Determining the chemical properties of U. S. Pipe – one of many quality checks.

INDUSTRIAL SERVICE CAST IRON

Birmingham 2, Ala. *A wholly integrated producer from mines and blast furnaces to finished pipe.*

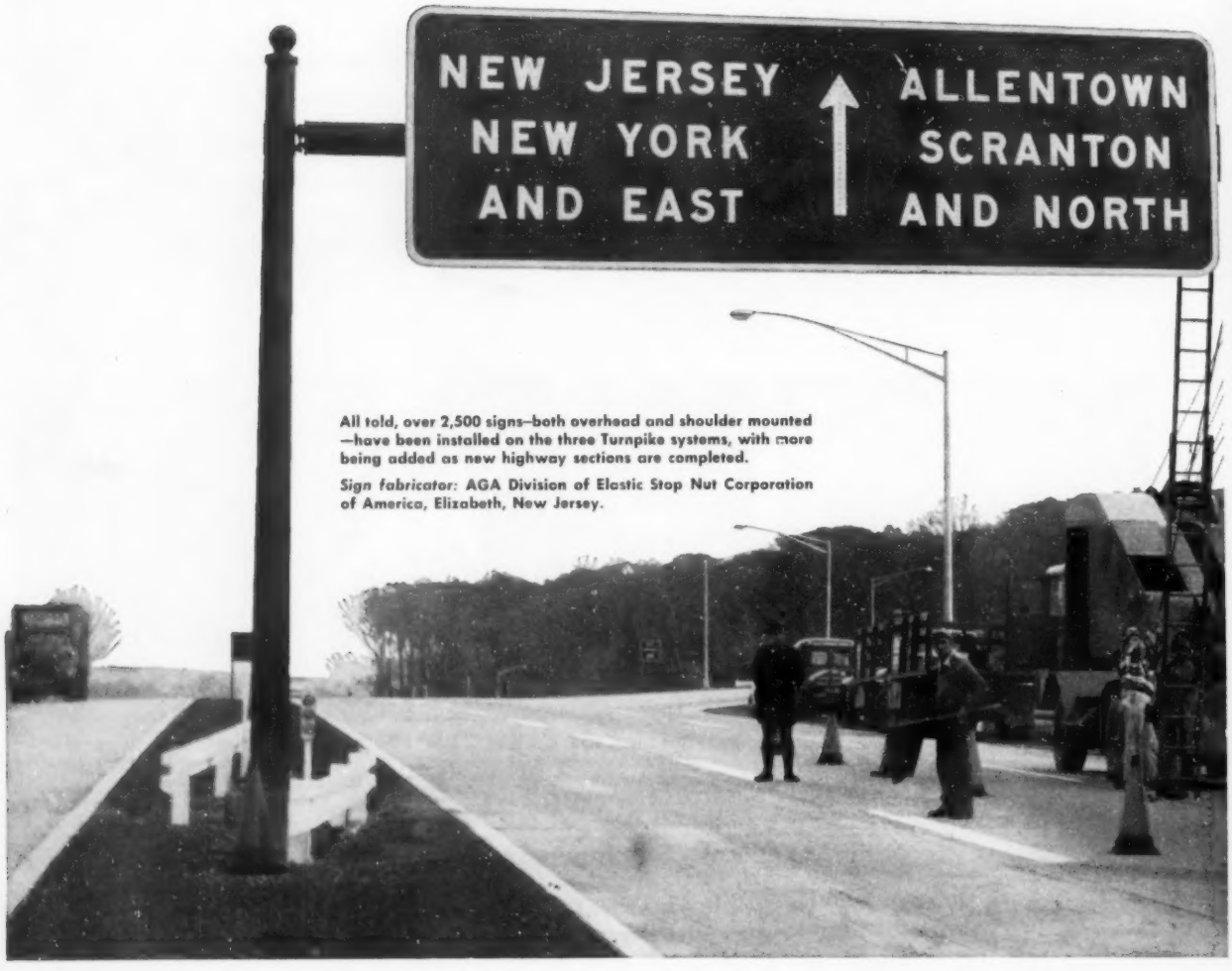
New Jersey Turnpike
New York State Thruway
Pennsylvania Turnpike

Overlaid plywood on the new

KING SIZE OVERLAID PLYWOOD SIGNS take the guesswork out of motoring along the new controlled access highways that speed traffic to and from the busy Eastern metropolitan areas.

Strategically located and reflectorized for nighttime legibility, these bright, easy-to-read signs make the New York Thruway and Pennsylvania and New Jersey Turnpikes a prime example of efficient highway signing. And because they cost less than signs of other materials—both initially and in long-term maintenance—overlaid plywood helps do this better signing job for less money.

Signs of overlaid plywood stand up better under severe weathering, deliberate or accidental abuse. Plywood's strength and stiffness simplifies framing. Standard panels can be easily cut or combined to make signs of any size or design. The durable plastic-like overlay prevents checking, provides an ideal base for paint or reflectorizing.



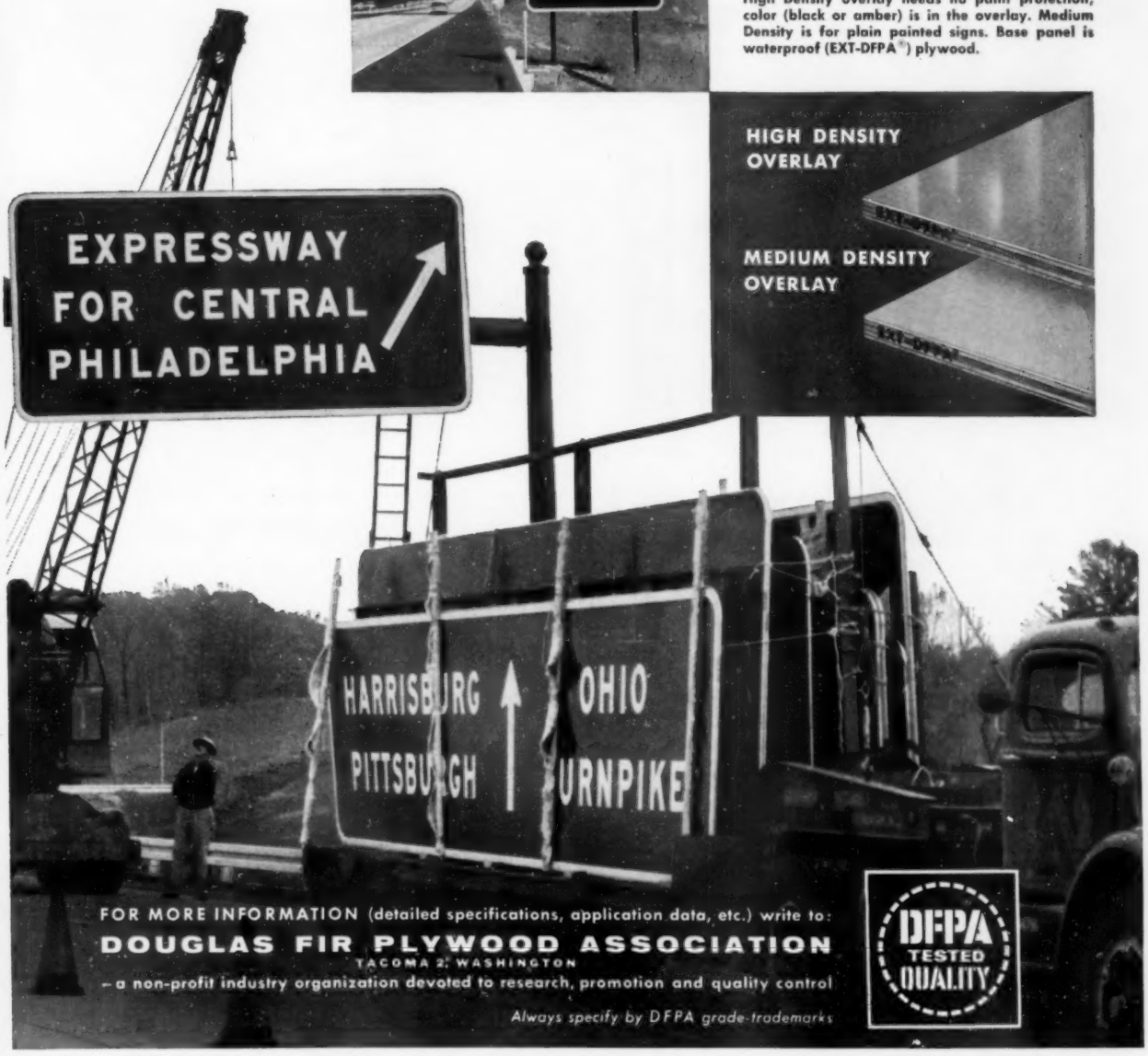
All told, over 2,500 signs—both overhead and shoulder mounted—have been installed on the three Turnpike systems, with more being added as new highway sections are completed.

Sign fabricator: AGA Division of Elastic Stop Nut Corporation of America, Elizabeth, New Jersey.

helps cut signing costs eastern turnpike systems

Overlaid plywood sign panels are stronger, more durable than metal. On shoulder mounted signs, fir plywood's greater stiffness means backing or supporting framework can be eliminated.

Durable overlay eliminates checking, grain raise. High Density overlay needs no paint protection; color (black or amber) is in the overlay. Medium Density is for plain painted signs. Base panel is waterproof (EXT-DFPA®) plywood.



FOR MORE INFORMATION (detailed specifications, application data, etc.) write to:

DOUGLAS FIR PLYWOOD ASSOCIATION

TACOMA 2, WASHINGTON

– a non-profit industry organization devoted to research, promotion and quality control

Always specify by DFPA grade-trademarks

DFPA TESTED QUALITY

MUELLER®

fire hydrants

...*for special applications*

These fire hydrants for special applications are just a part of the full line of fire hydrants produced for municipal, industrial and private fire protection systems by Mueller Co.

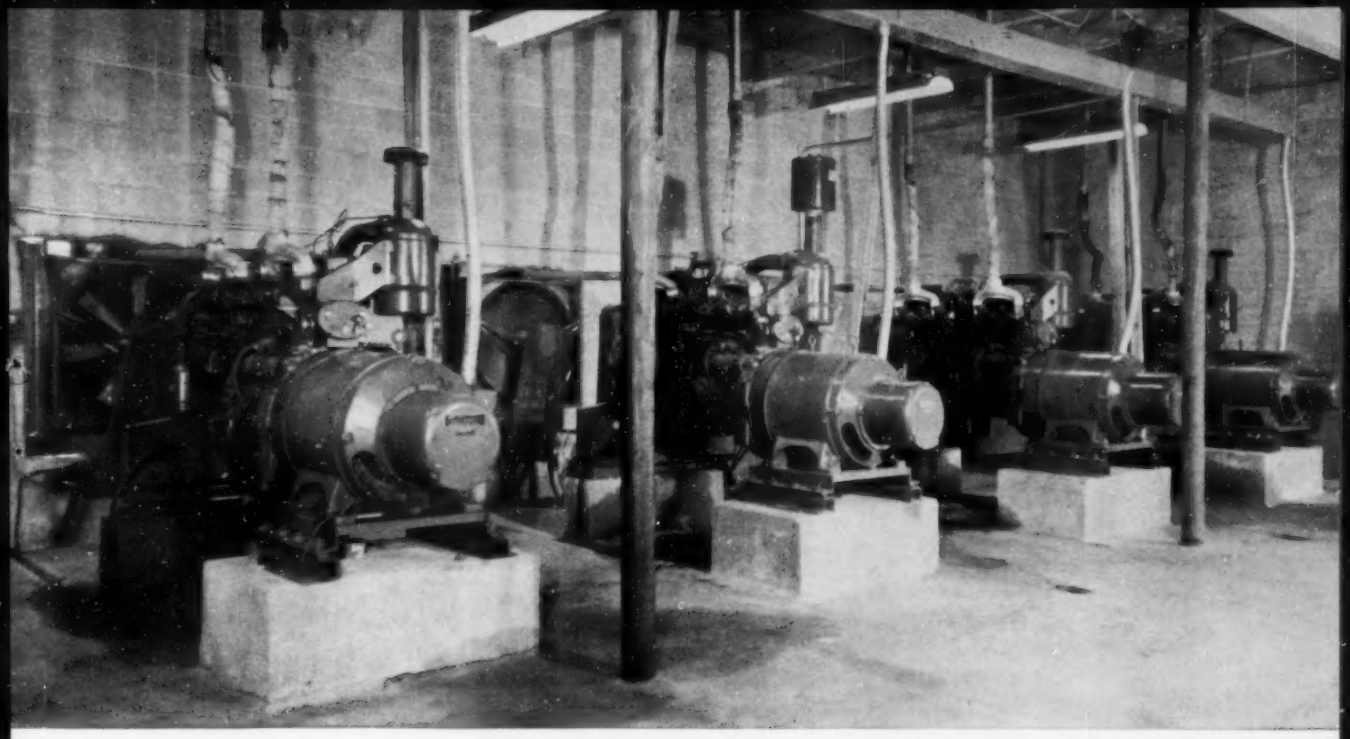
The design and quality of these special hydrants is exactly the same as Mueller AWWA Standard Fire Hydrants for municipal use. Compression type main valves, automatic drain valve mechanisms and "O" ring stem seals are just a few of the features. The only difference in the 2⅛" valve opening hydrants is size.

The use of these quality features in *all* Mueller fire hydrants is typical of the great attention to detail in research, design and engineering that becomes a part of every Mueller product made for the water industry.

Write for complete information.

MUELLER CO. **DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario



Large wall-mounted radiators and reverse flow fans powered by 5 hp motors cool the four International UD-1091 diesels.

No blackouts for 11 years in town lighted by four International powered generators

Power failures have been unknown for 11 years at Beatty, Nev. (pop. 650), where International diesel engines drive four Palmer generators in the privately owned power plant.

Revert Bros., Inc., originally used four UD-18 diesels but replaced them after 10 years with larger UD-1091 diesels to supply increasing electric power needs. Peak loads come at night and are now easily handled by operating only three of the four Palmer 100 KW generator sets.

"For 10 years our International UD-18's faithfully supplied Beatty with electricity," states Norman Revert, partner. "During that time they received ordinary maintenance yet we never had a failure or breakdown. Maintenance cost was remarkably low. Now the bigger UD-1091 diesels are beginning a long tour of dependable service. After a year's operation, we can only report complete satisfaction."

Located near Death Valley's eastern entrance, Beatty caters to tourists with four motels, four restaurants and several bars.

Your town can be assured this same dependable, low cost power when you approve the purchase of International engines for generators, pumps, or in construction machinery. Your power choice ranges from 16.5 to 385 max. hp in 24 diesel and carbureted engines including four brand new direct-start diesels.

International® Construction Equipment

International Harvester Co., 180 N. Michigan Ave., Chicago 1, Illinois

A COMPLETE POWER PACKAGE: Crawler and Rubber-Tired Loaders . . . Off-Highway Haulers . . . Diesel and Carbureted Engines . . . Motor Trucks . . . Farm Tractors and Equipment.

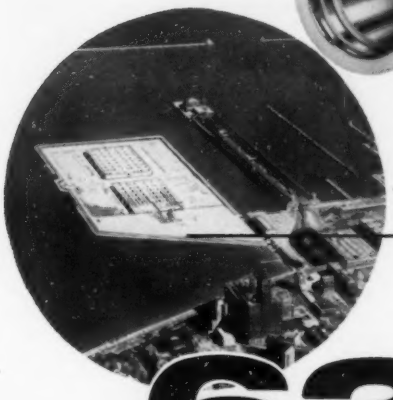
CLOW

Start of installation of Clow cast iron pipe with intermediate Bell-Tite joints in one of 192 half filter beds which compose the filter underdrain system. The Bell-Tite flare tees are first set in concrete. Note Chicago skyline in distance.

Installation of pipe and tees partially completed. Clow Bell-Tite joints permit easy and rapid assembly—an important factor especially in a job of this magnitude. Bell-Tite forms a pressure-tight joint instantly. Photo shows Neil Sullivan, pipe foreman for George D. Hardin, contractor (right), and Lewis C. Alk, Manager, Clow Technical Service Department.

CAST IRON

PIPE



In Chicago's huge filtration plant–

62 MILES OF CLOW CAST IRON PIPE

in filter underdrain system

Chicago's new Central District Filtration Plant, now under construction, will be the largest in the world. Located on a 61-acre tract of filled-in land on Chicago's lake front, it will have a normal capacity of 960 million gallons of water a day—a maximum capacity of 1680 million gallons a day. The plant was designed by Department of Public Works, City of Chicago, Bureau of Engineering, Filtration Design Division.

Over 62 miles of Clow 4" cast iron pipe—27,264 runs of pipe with 13,632 Bell-Tite® and flare tees compose the underdrain system for 192 half filter beds. Each pipe length is supplied with perforated holes with brass eyelets and has a cast iron plate welded in one end. Each Bell-Tite tee has two eyelet holes.

Easy, rapid assembly permitted by the Clow Bell-Tite joint contributes greatly to economical installation.

OUR 81st YEAR • 1878 TO 1959

JAMES B. CLOW & SONS, INC.

201-299 North Talman Avenue, Chicago 80, Illinois

Subsidiaries:

Eddy Valve Company,
Waterford, N.Y.

Iowa Valve Company,
Oskaloosa, Iowa

CLOW CAST IRON PIPE

Equipment and Materials for your PUBLIC WORKS PROGRAM

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

NEW LISTINGS

Specifications and Design Data for Aluminum Highway Railing

383. Specifications and design data dimensions of components of aluminum highway railing are covered in a 38-page catalog from Michael Flynn Mfg. Co., Aluminum Div., 700 East Godfrey Ave., Philadelphia 24, Pa. Check the reply card.

Modern, Welded Constructed Elevated Steel Tanks

382. Revised edition of Horton ellipsoidal elevated steel tanks of welded construction is available from Chicago Bridge & Iron Co., Advertising Dept., 332 South Michigan Ave., Chicago 4, Ill. The catalog is well illustrated and contains a table of standard tank dimensions for capacities ranging from 40,000 to 500,000 gals. Check the reply card today.

Deepwell Submersible Pumps for Municipal Water Supply

391. 6 and 8-in. Sumo submersible pumps are described in Bulletin No. B10001A from Sumo Pumps Inc., Stamford, Conn. Check the reply card for performance chart and specifications.

Road Construction and Maintenance Equipment Catalog

401. Scrapers, compaction equipment, street flushers and bituminous distributors are covered in Catalog No. SG-25 from Seaman-Gunnison Corp., 2763 S. 27th St., Milwaukee 15, Wisc. Check the reply card for descriptions and specifications.

64-Page Manual On Surface Treatments

404. Complete up-to-the-minute information on all types of surface treatments is covered in manual available from American Bitumuls & Asphalt Co., 320 Market St., San Francisco 20, Calif. The Manual provides on-job reference as well as engineering department use and it covers every step from pavement inspection to traffic-control on the finished pavement. Check the reply card.

Remote Supervisory Pump Operation

405. Bulletin RTM describes remote supervisory pump operation by using telephone lines for communication circuits. Write Healy-Ruff Co., 2255 University Ave., St. Paul 14, Minn., or check the reply card for data on this unit for water and sewage works.

Water, Sewage and Industrial Waste Treatment Equipment

410. Catalog 2617 gives descriptions of the various items of sanitary engineering equipment made by Link-Belt. Check the reply card or write Link-Belt Co., Colmar, Pa., for details on screens, grit collectors, mixers, feeders and sludge collectors.

Aluminized Chain Link Fence Fabric

415. Styles, gauges, construction features and heights of chain link fence are listed along with typical installation photographs. For a copy of Bulletin DH-16B write Page Steel and Wire Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport 2, Conn.

Measurement of Liquid Flow Across Weirs

418. The Burgess-Manning Type ML meter is applied to weir boxes for measurement of flow across 90° V-notch weirs. For specifications and installation procedures write Burgess-Manning Co., Penn Instruments Div., 4110 Haverford Ave., Philadelphia 4, Pa.

Armco Pipe Piles, Caissons and Pile Shells

423. Typical installations, field operations and how to specify Armco pipe piles, caissons and Hel-Cor pile shells are covered in Catalog FP-13558 from Armco Drainage & Metal Products, Inc., Product Information Service, Middletown, Ohio. Check the reply card.

All-Purpose Line of Oliver Tractors

428. Wheel and crawler tractors in sizes from 26 to 90 belt hp are described in catalog from The Oliver Corp., 400 West Madison St., Chicago 6, Ill. Check the reply card for full details.

Horizontal Vibrating Screens for Aggregate Screening

431. Types, models, dimensions and screen openings are included in Bulletin CS-6 available from Iowa Mfg. Co., Cedar Rapids, Ia. Check the reply card.

Fischer & Porter Magnetic Flowmeter Catalog

436. Catalog 10D1416 gives complete data on F & P obstructionless magnetic flowmeter for metering waste sludges, sewage and slurries. Principles of operation and advantages are covered. Check the reply card or write Fischer & Porter Co., 38 Jacksonville Rd., Hatboro, Pa.

Transite Pipe for Water Systems

447. The installation, operation and maintenance economies of Transite® pipe and the Ring-Tite® coupling for pressure water lines are described and illustrated in literature offered to engineers from Johns-Manville, 22 East 40th St., New York 16, N. Y. Check the reply card for tables of weights, sizes and pressure classes.

Kaiser Aluminum Bridge Railings and Components

451. A 24-page catalog covering engineering data and installation of aluminum bridge railings is available from Kaiser Aluminum & Chemical Sales, Inc., Dept. NR-27, 919 North Michigan Ave., Chicago 11, Ill. Check the reply card.

Pfaudler Permutit Equipment for Treating Industrial Wastes

457. Bulletin No. 4486 highlights not only the equipment but the engineering services and the complete waste treatment systems offered by Pfaudler Permutit. Check the reply card or write The Permutit Co., Div. of Pfaudler Permutit Inc., 50 West 44th St., New York 36, N. Y., today.

American Ductile Iron for Pipe, Tubing, Casing and Fittings

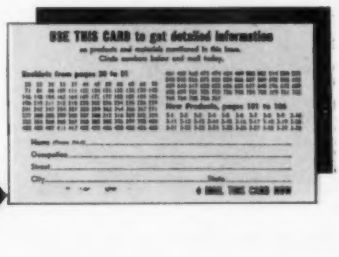
463. A 36-page illustrated catalog that describes the complete line of American Ductile iron products is available from American Cast Iron Pipe Co., P. O. Box 2603, Birmingham 2, Ala. Check the reply card for technical data including grades, specifications, dimensions and weights, uses and applications.

Portable, Submersible Pump for Construction

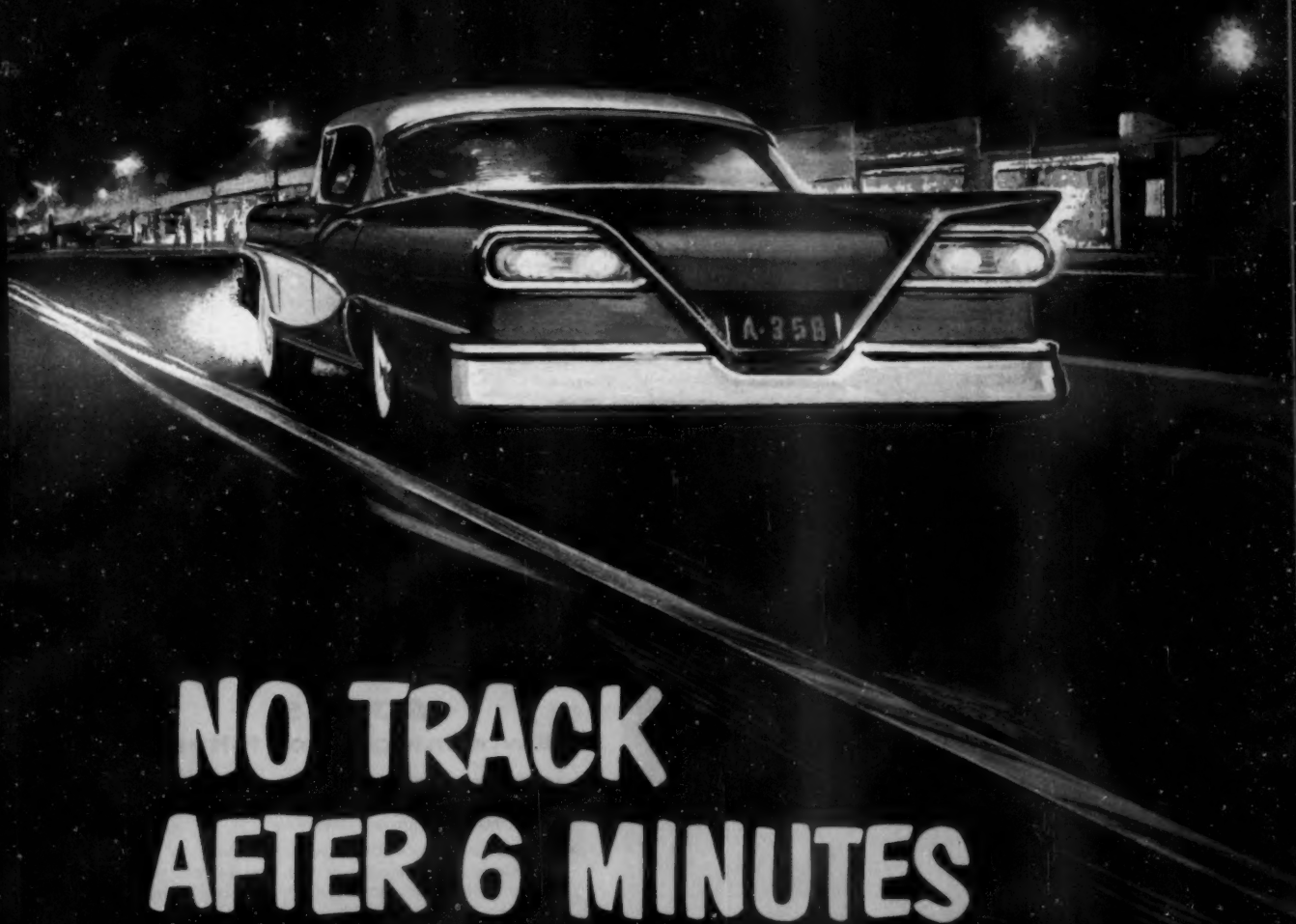
464. A portable electric pump is described in literature from Stenberg Mfg. Corp., Hoosick Falls, N. Y. Pump weighs 1,200 lbs., has a maximum capacity of 3,000 gpm and will pump to a maximum head of 220 ft. Check the reply card.

Chemical to Control Landfill Odors

501. Cloroben Landfill and Refuse Spray applied to landfill areas in 1 to 5% dilutions prevents and eliminates obnoxious odors. Mosquito and fly larvae are exterminated. Spraying or flushing of garbage trucks with 1% dilution of CL&R Spray will provide effective odor and insect control in these vehicles. Write Cloroben Chemical Corp., 115 Jacobus Ave., South Kearny, N.J.



Next time ... Stripe with *Cataline* ...



NO TRACK AFTER 6 MINUTES

Slow drying traffic paint ... a few uncooperative motorists ... and your striping job goes sour. The paint was at fault ... but you get the criticism.

Next time ... stripe with Cataline Reflective Striping ... it dries *FAST!* It's a special formulation based on Parlon® chlorinated rubber and millions of weatherproofed microscopic glass beads. Available as pre-mix or drop-on, Cataline will not track after 6 minutes ... is completely dry in 20. It gives you brilliant reflectorization and will far outlast any plain stripe you've ever laid.

Say good-by to smeared, hard-to-see pavement markings ... give your stripes a new lease on life ... with Cataline. Write for information, today.

Cataphote
CORPORATION
TOLEDO 10, OHIO / JACKSON, MISSISSIPPI

Manufacturers of CATAPHOTE REFLECTIVE BEADS • CATAFLEX REFLECTIVE COATING • CATALINE REFLECTIVE STRIPING
CATATHERM REFLECTIVE PLASTIC STRIPING • TRAFFIC SIGNS • STREET NAME SIGNS

NEW LISTINGS (Cont.)

Calcium Chloride Pellets for Ice Control, Concrete and Tire Weighting

404. Data on the use of pellet calcium chloride in all its major applications is presented in Bulletin C-59 available from Wyandotte Chemicals Corp., Michigan Alkali Div., Wyandotte, Mich. Check the reply card for specific gravity charts, dissolving charts and properties of calcium chloride.

Peripherally Fed Circular Settling Tanks

466. A 6-page bulletin having a cross section diagram of the Rim Flo Clarifier and a drawing showing the water flow is available from Chain Belt Co., Milwaukee 1, Wisc. Check the reply card.

Design, Operation and Construction of Oliver Rotary Filter

467. Design variations of filter drums, filtration media, filter tank agitators, valves and discharge mechanisms are covered in Bulletin No. 7200 available from Dorr-Oliver, Inc., Havemeyer Lane, Stamford, Conn. Check the reply card for full specifications.

Turret Derrick, a Tool for All Utility Work

471. Truco Turret Derrick quickly folds into a compact unit within the length of the truck and can handle a hydraulic digger that digs the hole and sets the pole. Complete catalog from Truck Equipment Co., 3963 Walnut St., Denver 5, Colo., or check the reply card.

Parshall Measuring Flumes

498. Measure water accurately with all-steel Parshall measuring flume. Free-flow discharge tables, formulas, weights, capacities and dimensions are covered in Catalog B-21-C available from Thompson Pipe & Steel Co., 3025 Larimer St., Denver 1, Colo. Check the reply card.

Continuous Gas and Vapor Analyzer

477. For use in measurement of sulfur dioxide and chlorine in air pollution control, the Davis Electro-Conductivity Analyzer continuously records level of sulfur dioxide and chlorine in atmosphere in the vicinity of stack gas discharge or gas storage. For details write Davis Instruments, Div. of Davis Emergency Equipment Co., Inc., 47 Halleck St., Newark 4, N. J., or check the reply card.

Drawings and Specifications on Aluminum Bridge Railings

488. 26 separate drawings of aluminum bridge railings on tracing paper for convenient use of highway and construction engineers are available from Reynolds Metals Co., Department PRD-5, Box 2346, Richmond 18, Va. Check the reply card.

Increase Power Production and Profit of Crawler Tractors

497. A comprehensive discussion of the capabilities of large crawler tractors is covered in 12-page Bulletin No. D841 from Advertising Div. of Caterpillar Tractor Co., Peoria, Ill. Check the reply card for full details.

Handbook on Aluminum Traffic Control Devices

516. Subjects covered in this handbook are sheet signs, extruded signs, sign posts, street signs, and complete specifications for many aluminum uses. A list of Alcoa sales offices is included. Check the handy reply card or write to Aluminum Company of America, Alcoa Building, Pittsburgh 19, Pennsylvania, for mounting, determining size of sign posts and other information today.

Plastic Filament Street Sweeper Pick-Up Brooms

517. Literature is available from Rynal Corp., 114 St. Joseph St., Arcadia, Calif., on plastic filaments for street sweeper pick-up brooms. They are easy to replace, storage space is eliminated and moisture will not attack them.

What's Your Digging Problem? Repair Work? Trenches? Footings?

518. At today's prices, hand digging means the job will be costly. You can dig through asphalt and macadam; work fast and efficiently even in cramped areas with the tractor mounted Sherman Power Digger. From one position you can reach to dig 14 feet behind tractor in 180° arc and dig to a depth of 12 feet. For full details check the reply card. Sherman Products, Inc., Royal Oak, Mich.

Portable Water Coolers For Every Need

526. Water cooler sizes range from 1½, 2, 3, 5, 10, 15, 20, 25 and 30-gal. and are used on highway construction and maintenance and where-ever outside work is done. Check the reply card or write Horton Equipment Co., P. O. Box 2611, Houston 1, Tex.

Data and Specifications on Aluminum Grating Walkways

531. Aluminum walkways for bridges, sewage and water treatment plants and garages are covered in bulletins available from Washington Aluminum Co., Inc., Knecht Ave. & Pennsylvania R. R., Baltimore 29, Md.

Overlaid Plywood Makes Signs Look Better, Last Longer

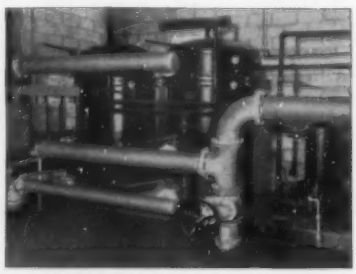
541. Complete information and a sample of GPX medium-density overlaid plywood are available from Georgia-Pacific, Dept. PWM, Equitable Bldg., Portland, Ore. Check the reply card for data on this plywood for traffic signs.

Up-Sewer Chemical Rotation Method Controls Odors and Insects

542. By using the Cloroben Up-Sewer Rotation Method, accumulated grease deposits and slime formations are dissolved; sulfide production and roaches eliminated in laterals, branch sewers, lift stations, wet wells and force mains. This method is an effective and economical means of assuring the delivery of a non-septic, stabilized influent to the treatment plant. Write Cloroben Chemical Corp., 115 Jacobus Ave., South Kearny, N.J. for your copy.

- BAKER PARK MUNICIPAL POOL, Frederick, Maryland, 400,000 gallons
- Filter System Design, W. R. Walter, City Engineer, Frederick, Maryland
- Filters: 2-SPF-169 R. P. Adams Company, Inc.

Shown is a typical Adams SPF Swimming Pool Filter installation. These filters are available in a wide range of sizes for pools of 50,000 to several million gallons capacity. All sizes are normally available from stock. We do not offer a filter for backyard pools.



HERE'S WHY MANY CITIES INSIST ON

ADAMS

Swimming Pool Filters

- **LOWER INSTALLATION COSTS** because it takes only a fraction of the floor space of sand filters . . . does not require massive concrete foundations.
- **TROUBLE-FREE OPERATION** . . . you never have to disassemble it for cleaning . . . as one city engineer said, "Yours is the only diatomite filter with backwashing that works".
- **PERMANENT PORO-STONE MEDIA** is inert to chemical corrosion and electrolytic action of chlorinated water. —All Adams SPF filters now in service are still equipped with the original tubes.
- **QUALITY IN EVERY PART** . . . stainless steel support rods and nuts for the tubes . . . galvanized forged steel closure plates and clips . . . *three* coats of vinyl plastic lining on sand blasted inner surfaces.

The R. P. Adams Company is the nation's largest manufacturer of filters exclusively for municipal, commercial and institutional pools.

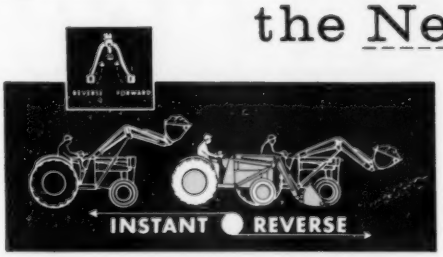
For detailed information, write for our new technical Bulletin 626. It was prepared to help you with your swimming pool filter problems.

Our diatomite filters for municipal water supplies is discussed in Bulletin 651. Ask for it at the same time.

R. P. ADAMS CO., Inc. • **228 East Park Drive, Buffalo 17, N. Y.**

To order these helpful booklets check the reply card opposite page 36.

M-F takes a New Approach to Utility Tractors



the New WORK BULL 204
with TORQUE CONVERTER
change directions INSTANTLY
at a Touch of the Toe —no SHIFTING

Here's the most important development ever made on an Industrial Utility Tractor. A new ease and efficiency of operation is yours with the all-new **Work Bull 204** – designed for you...to your requirements. No more cumbersome shifting of gears to change direction of travel. With the simplified and field-proven three-pedal control, you can move in either forward or reverse instantly and smoothly...or simply accelerate the engine with a mere touch of the toe. And a torque converter – also a **first** for Utility Tractors – maintains the correct power-to-load ratio. Has four equal speeds either direction to give a wide work range as well as favorable road speeds. It has a powerful 40-hp, high-torque engine. Full-time power steering is another standard feature. Of course, the Work Bull 204 is power matched with the M-F Davis Loader and Backhoe. It has the exclusive Ferguson 3-point hitch with hydraulic draft control for Scarifier-Scraper or other rear-end attachments. See it today and you'll agree it's the ultimate of utility tractors. ***Write for name of nearest dealer.***

Work Bull 1001 Work Bull 303 with 500 Loader and Davis Backhoe Work Bull 202 with Davis Loader and Backhoe Work Bull Fork Lift

MASSEY-FERGUSON INDUSTRIAL DIVISION
1009 SOUTH WEST STREET • WICHITA 13N, KANSAS

WATER WORKS

Equipment For Water, Sewage and Industrial Waste Treatment

24. The complete line of Jeffrey equipment for treatment plants is covered in a 64-page Catalog 952 available from The Jeffrey Mfg. Co., Columbus 16, Ohio. Check the reply card for information on bar and disc type screens, traveling water screens, grinders, grit collectors, garbage grinders, sludge, draw-off valves, chemical feeders, bucket elevators and scum removers to mention some of the equipment.

In-Place Cement Lining of Small and Large Pipe

25. A catalog describing a process of in-place centrifugal cement lining of pipes from 4 to 144 ins. in diameter is available from the Centriline Corp., Raymond International Inc., 140 Cedar St., New York 6, N. Y. Check the reply card for sample specifications and test results.

Handbook of Cast Iron Pipes and Fittings

52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use in reference.

How Eleven Cities Installed Water Meters

56. This 8-page bulletin describes the planning and operational procedures used by 11 water departments and companies in the installation of about 200,000 water meters. Check the reply card or write The Ford Meter Box Company, Inc., Wabash, Ind., for methods of installation and rate cards.

Elevated Tanks and Other Storage Facilities

32. Specification sheet covering elevated tank sizes and design and illustrated brochure available from the Darby Corp., Kansas City 15, Kansas.

Catalog on Synchronous Motors and Controls

64. A 27-page Catalog B-7292 on synchronous motors and controls is well illustrated and contains motor selector charts, application data, and formulas for calculating power factor. For a copy write Westinghouse Electric Corp., Box 2099, Pittsburgh 30, Pa., or check the reply card.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews and R. D. Wood fire hydrant and R. D. Wood gate valves.

Manual on Instrument Accessories and Supplies

96. The 60-page loose-leaf book, Catalog 500, includes specifications, part numbers and prices for more than 250 commonly furnished instrument parts and supplies. It is divided into 5 sections: Mechanical; pneumatic; electric-electronic, general, and tools and service. Check the reply card or write The Foxboro Co., Foxboro, Mass., for your copy.

Easily Cleaned Long Run Filter Bed Media

70. Bulletins on Anthrafilt tell the reasons why selected, graded crushed anthracite is superior to sand as a filtering material. Have you made a full investigation? Write Anthracite Equipment Corp., Wilkes-Barre, Pa.

Right Angle Gear Drive For Centrifugal Pumps

107. Applications, gear drive selection tables, pulley data, efficiencies and standard dimensions of Johnson right angle gear drives are covered in catalog from Johnson Gear & Mfg. Co., Ltd., Eighth and Parker Sts., Berkeley 10, Calif. Check the reply card.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Use The Reply Card

AWWA Fire Hydrants and Gate Valves

155. Above-ground maintenance Mueller AWWA improved fire hydrants and minimum maintenance Mueller AWWA non-rising stem gate valves are described in literature from Mueller Co., Decatur, Ill.

Now Every Municipality Can Own a Trencher

173. The low cost of the ARPS Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 7 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the reply card.

TOUGH

Yes, the Tarco "Litter-Shark" **is a tough . . . rugged . . .** vacuum-type litter collector. "Litter-Sharks" in use over 2 years with no major parts replacement proves its ruggedness.

Picks Up: newspapers, paper wrappings, plates, and cups; milk cartons; **tin cans;** grass clippings and leaves.

Features: Heavy **all-steel suction impeller.** Replaceable stainless **steel suction case liner.** Bag carrying rack. Exclusive **Dust Control feature** (pat. pend.). Full castoring, load carrying third wheel.

Simplify your employees' job and minimize your litter problem. Write for your nearest dealer's name and have him demonstrate a "Shark" without obligation for you.

TARRANT MFG. CO.
28 JUMEL PLACE, SARATOGA SPRINGS, N. Y.

TRENCHES

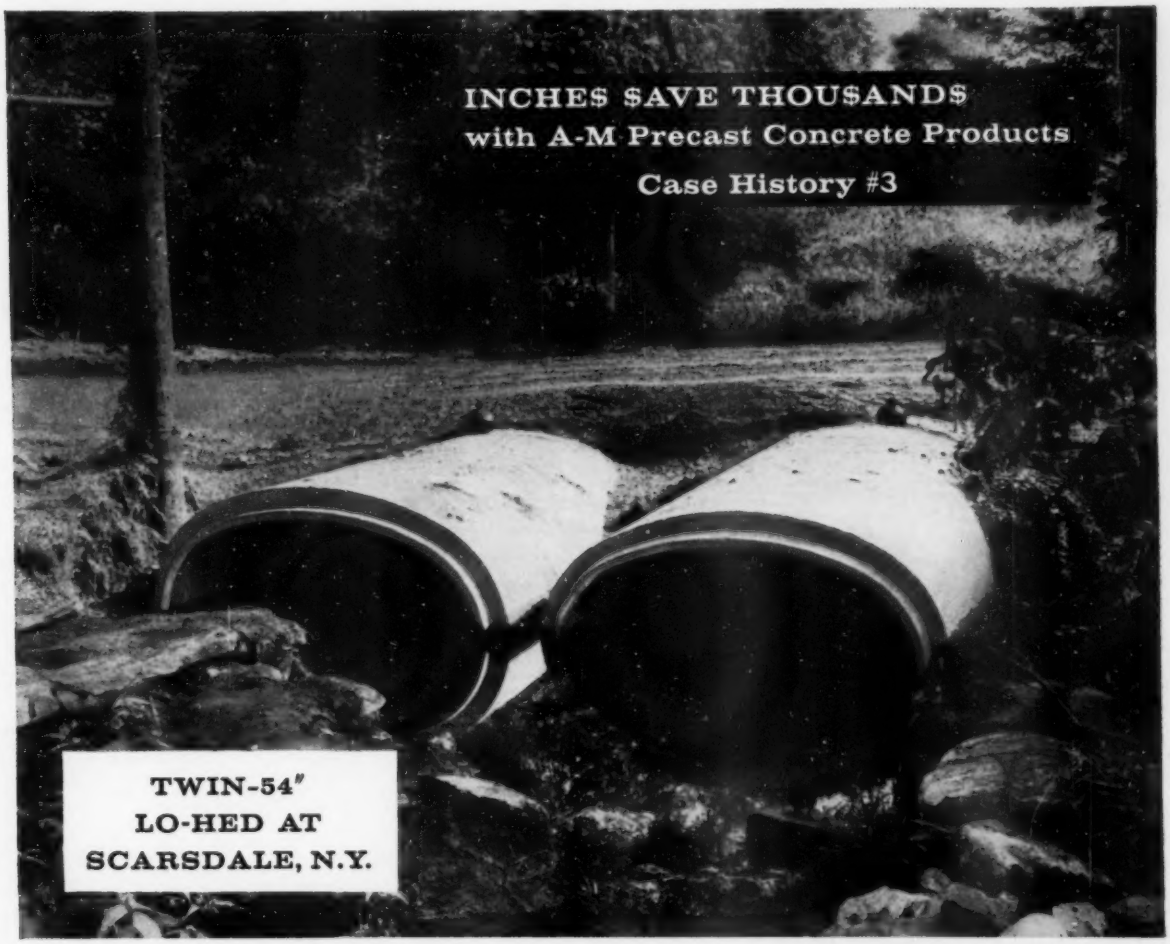
2¾" to 8" wide • Depths to 6'
Self-Propelled•Hydraulic Drive
Low Cost • Pays for Itself!

The economic Arps Model M-A Trench-Devil will handle most of your trenching jobs faster, easier and at lowest cost per foot of trench. For the largest percentage of ditching work — foundations, water services, underground wiring, gas lines, sprinkler systems — this heavy duty, one-man outfit will outdig larger units costing many times its low price. Get more information *now* on this and other famous Arps Trenchers for larger and smaller jobs. The Arps Corporation, New Holstein, Wis. Dept. PW

ARPS CORPORATION NEW HOLSTEIN, WIS.

TRENCHERS
HALF-TRACKS • BULLDOZERS
UTILITY BLADES

To order these helpful booklets check the reply card opposite page 36.



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To order these helpful booklets check the reply card opposite page 36.

Manual on Filter Bed Agitators

206. General information-specifications and installation data regarding the application of Palmer agitators, or rotary surface wash in vertical and horizontal pressure filters—round, square and rectangular open gravity type filters are covered in Manual from Palmer Filter Equipment Co., 822 East 8th St., P. O. Box 1696, Erie, Penna. Check the reply card.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Catalog on Dewatering Pumps

226. Centrifugal and diaphragm pumps for dewatering jobs are described in Catalog DP7 from The Jaeger Machine Co., 550 West Spring St., Columbus 16, O. Models, specifications and performance tables are included. Check the reply card.

Clow Bell-Tite Cast Iron Pipe

280. Laying water mains is easier, faster and more economical with Clow Bell-Tite joint cast iron pipe. Joint employs a single rubber gasket as the only accessory. Complete details available in illustrated literature from James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

Waterworks and Municipal Castings

293. Meter boxes and covers, yokes and couplings, service boxes and manhole covers are covered in 24-page catalog. Check the reply card or write H. W. Clark Co., Mattoon, Ill., for full specifications.

Trenching Equipment Data Conveniently Assembled

212. The entire line of Cleveland trenching and backfilling equipment is now covered in a single bulletin, with material arranged for quick comparison of capacities, specifications and dimensions of all models. Twenty-four action photos graphically illustrate various job applications. Get Bulletin S-120 now for easy review of your trenching equipment needs. Just check the reply card or write to the Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

Manual on the Hersey Disc Water Meter

329. Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey Mfg. Co., 250 Elm St., Dedham, Mass. Size ranges are ⅝"-¾"x¾"-¾" and 1". Check the reply card.

Use The Reply Card

Helpful Data on Water Meters

330. It is to the interest of every water works superintendent and engineer to have full data on dependable Badger water meters and related meter products. Complete data on all types of disc, turbine and compound meters, meter test equipment, yokes, strainers and alarm registers are supplied in an attractive binder by Badger Meter Mfg. Co., Milwaukee 18, Wisconsin.

Technical Bulletin on Swimming Pool Filtration Equipment

335. A 24-page technical Bulletin 626, designed to help persons planning pools which must comply with local and state health regulations, is now available from the R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. Check the reply card for data on size selection charts, typical installations and drawings.

Manual on Pipe Finding Techniques

213. A manual on special pipe finding and leak detecting techniques of interest to utilities, municipalities, oil and gas companies is announced by Fisher Research Laboratory, Inc., 1961 University Ave., Palo Alto, Calif. The manual contains a number of articles on locating buried pipes and cables and detecting and locating fluid leaks in pipe lines.

Tips for Installing Orangeburg Pipe

336. Good practice for installation of Orangeburg pipe and fittings is outlined in an illustrated four-page bulletin made available by the Orangeburg Mfg. Co., Inc., 375 Park Avenue, New York 22, N. Y. Trenching and backfilling, pipe laying, cutting and connecting with other types of pipe are included.

Concrete Admixtures and Joint Sealers

346. Retarding and accelerating densifiers for concrete and mortar, coatings for exposed aggregate concrete, non meltable mastic waterstops and quicksetting products are covered in 8-page bulletin available from Sika Chemical Corp., 29-49 Gregory Ave., Passaic, N. J.

Information on Boring Machines

365. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Earthworm Boring Machine, Inc., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included.

Data on Adjustable-Speed Magnetic Drives for Low-Lift Pumps

465. A catalog is available from Electric Machinery Mfg. Co., Minneapolis 13, Minn. that tells all about E-M Vertical Synchronous Motors and Magnetic Drive Units. Engineers check the reply card for information on this equipment for sewage pumps.

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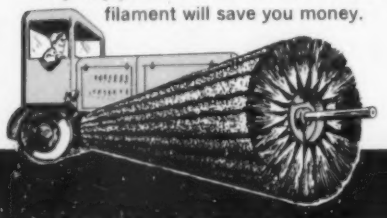

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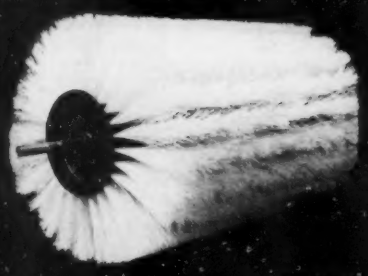

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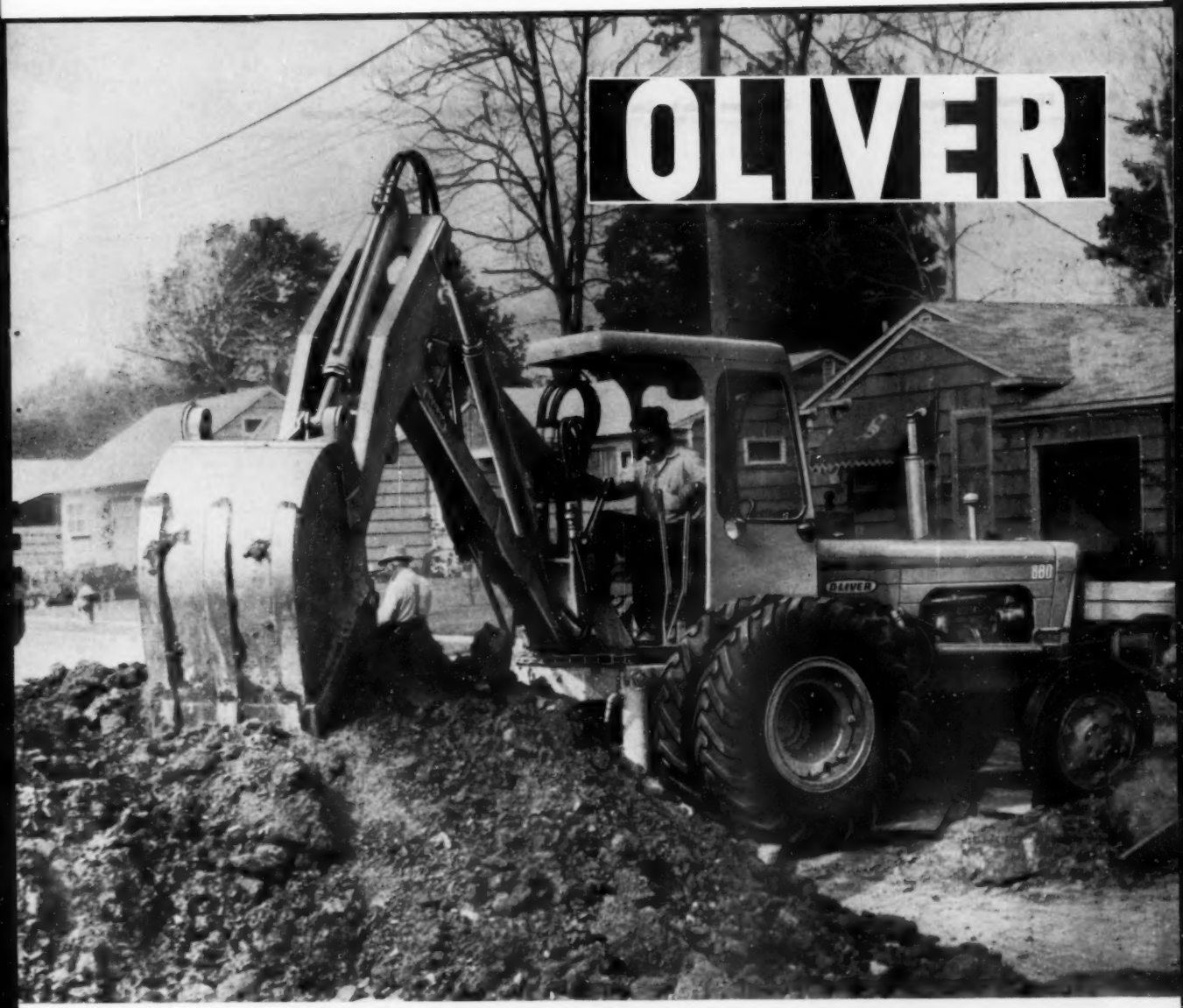

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The Oliver 880 tractor can also be equipped with a factory-matched 1-yd. bucket—making it a true heavy-duty loader. This unit is highly mobile, with travel speeds from 2 to 17 m.p.h. Gas or diesel power.

When this Oliver Model 80 Hydro-Trencher "took over" the job of digging 50-foot laterals in the rocky shale of Staten Island, Patsy Iaizzo, local contractor, happily noted two important benefits: 1. An immediate 75% increase in production over any of the three trencher combinations that he had been using. 2. A saving of at least $90 per month in fuel alone.

Savings like this are common among owners of this combination —the Oliver 880 tractor equipped with the Model 80 trencher. The ½-yd. bucket digs and loads to 12 feet. The boom swings 180° and the dual-circuit hydraulic controls allow raising or lowering the bucket while swinging. Result: faster work cycles. Now municipalities, utilities and contractors can rip out pavements, dig in hardest soils (even frozen ground)—and do these jobs with a unit that can travel anywhere on busy streets.

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Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio

a complete line of industrial wheel and crawler tractors and matched allied equipment

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How to Eliminate Seepage On Construction Projects

472. Labyrinth waterstops are easily installed to provide the answer to the seepage problem and simply form work on all types of construction jobs. Investigate their use for water and sewage plants, reservoirs, swimming pools, etc. For full data check the coupon or write to Water Seals, Inc., 9 So. Clinton St., Chicago 6, Ill.

U. S. Tyton Joint Pipe

490. An eight page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids has been announced. The newly developed Tyton Joint is simple, sturdy and tight. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co. Birmingham 2, Ala., or check the reply card.

V-Notch Chlorinator For Chlorine Flow Control

502. An 8-page catalog on the W & T Series A-721 chlorinator is available from Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J. Chlorinator is adaptable to any type of chlorinator control and feed rate may be controlled manually or automatically.

Complete Manual on Smith Gate Valves

533. Normal range of sizes and pressures, the standard valve-end combinations available, the varying methods of operation, as well as valves for special services are some of the material covered in this manual. Check the reply card or write The A. P. Smith Mfg. Co., East Orange, N. J., for your copy.

Manual on Valves, Fire Hydrants and Accessories

559. A 244-page manual covering Darling valves and fire hydrants in a broad range of types, sizes and constructions is available from Darling Valve & Mfg. Co., Williamsport, Pa. Engineering data, application tips, valve accessories information, reference data on materials, specifications and standards are covered.

Coagulant Aids for Use in Municipal and Industrial Water Treatment

574. A 4-page bulletin describing Hagan coagulant aids points out how these aids speed up floc formation and also how they tend to produce larger and tougher flocs over wider pH ranges than coagulants alone. Check the reply card or write Hagan Chemicals & Controls, Inc., 323 Fourth Ave., Pittsburgh, Pa., for complete data.

Filter Sands and Under Drain Gravels

614. Filter sands and gravels for municipal water plants are described in literature available from Eau Claire Sand & Gravel Co., Eau Claire, Wis. Check the reply card for data on sizes available, silica content and content of magnesium, calcium carbonates and iron oxides.

Slide Rule For Chemical Feed Calculations

627. A very handy chemical feed calculator is available from Industrial Chemical Sales Division, West Virginia Pulp and Paper Co., 230 Park Ave., New York 17, N. Y. Pounds per million gallons, grains per gallon and grains per gallon of CaO from lime are several of the calculations that can be made. Check the reply card today.

AWWA Butterfly Valves Custom Built to Specifications

630. Butterfly valves that can be operated by air, oil, water, electrically or manually and are made in standard sizes to 24 ins. are fully described in literature from Fabri-Valve Co. of America, P. O. Box 4352, Portland 8, Ore. Check the reply card for full specifications.

Water Filtration Costs Can Be Reduced

692. The "Celite" system of diatomite filtration makes possible reduced installation cost, with space requirements a fraction of those for equivalent sand filtration. For informative literature write Johns-Manville, Box 14, New York 16, N.Y.

Copper Sulfate In Control of Microscopic Organisms

529. This valuable 52-page manual on the use of copper sulfate in the control of microscopic organisms in water supplies is available from Phelps Dodge Refining Corp., 300 Park Ave., New York 22, N. Y. Covered are organisms, odors, methods of using copper sulfate, calculation tables and table showing chemicals required for treatment of different Genera.

Water Tanks, Reservoirs and Standpipes

631. Data on steel water tanks, reservoirs and standpipes of all capacities are included in literature available from Graver Tank & Mfg. Co., Inc., East Chicago, Ind. These units are fabricated and erected by the company. Check the reply card.

A Different Form of Pneumatic Instrumentation

658. The "C.-A.-P. System" instruments use controlled air pressure in the 0.25 to 3.25 psi range to operate an air motor for positioning valves, regulating chemical feed rates and indicating and recording measurements of flow, level or pressure. For Bulletin 1100-B describing this system, write Infilco Inc., P. O. Box 5033, Tucson, Arizona, or check the reply card.

Turn Your Water Meter Reading Inside-Out

671. The Visi-Meter is a remote recording and indicator system that eliminates the need of entering the home to read water meters. It records within an accuracy of 0.1 percent. Check the reply card or write Visi-Meter, Inc., 301 North 17th St., Kansas City, Kans., for literature.

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours is described in literature from Wilkinson Products Co., 3987 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

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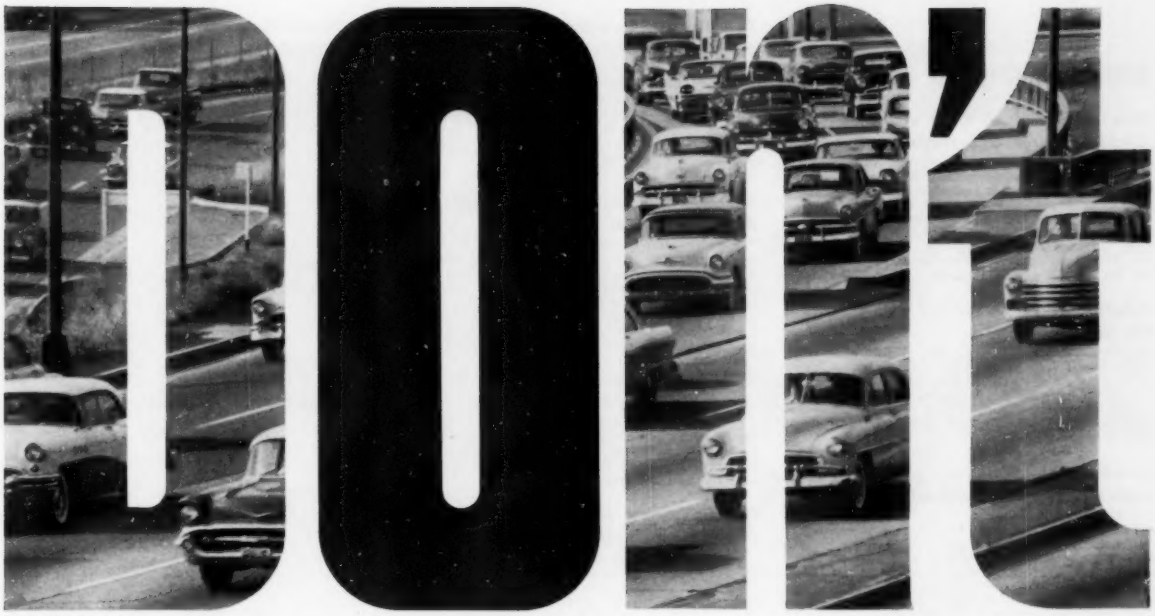

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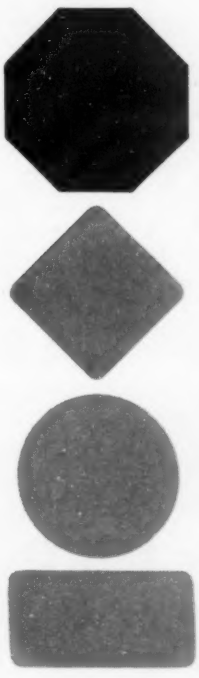

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SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

Helpful Design Data For Sewage Ejectors

81. The application and advantages of pneumatic sewage ejectors are outlined in bulletin S-55 of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems.

Automatic Engine Control Equipment Manual

83. This catalog contains descriptions of standard automatic and semi-automatic controls and control equipment. General control recommendations, control selection chart, accessory selection chart, safety stop controls and alarm sets are sections covered. For price lists and models available write Synchro-Start Products, Inc., 8151 N. Ridgeway, Skokie, Ill.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

Clarifier and Oxidator[R] Mechanisms for Water and Sewage Treatment

112. Catalog SM-1005 describes the Eimco-Process Clarifiers and Oxidators[R] that cover a full range of tank sizes and load requirements and special units for unusual conditions in water, sewage and industrial waste treatment. Check the reply card or write Process Engineers, Inc., 420 Peninsular Ave., San Mateo, Calif., for your copy.

Handbook for Engineers on Design and Construction of Culverts

121. Metal pipe specifications, highway, municipal and airport drainage facts, selecting a drainage structure, designing waterway area, designing for structural strength and headwalls and inlets are sections covered in this handbook. Check the reply card or write Republic Steel Corp., Culvert Div., 2318 — 13th St., N.E., Canton 5, Ohio.

Submersible Electric Pumps For Dewatering Problems

167. Pumps range in size from 1½"-85 gpm capacity to 8"-300 gpm capacity, with head capacities up to 210 ft. Write to Stanco Mfg. & Sales Inc., 1666 Ninth St. (Corner of Olympic & Ninth), Santa Monica, Calif.

Get Data Now on This Catch Basin Cleaner

198. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit, Netco Div., Clark-Wilcox Co., 118 Western Ave., Boston 34, Mass. Check the reply card.

Dependable Engines for Sewage Treatment Plants

227. Climax Sewage Gas Engines are available for continuous duty operation to drive pumps, blowers or generators in a range of sizes from 40 to 250 HP. Use the handy reply card to obtain complete details and literature from Climax Division, Waukesha Motor Co., Box 379, Waukesha, Wisc.

A Short Course In Pipe Jointing

169. The story of rubber couplings for clay and concrete pipelines is graphically presented in the booklet "Pipe Enterprise", published by Hamilton Kent Mfg. Co., Kent, Ohio. Detailed description of pipe jointing methods; photos showing jobs where Tylox gaskets met the need for easily assembled permanently tight joints installed under all conditions; and a report on the development, manufacture and outstanding features of the compression type gasket make this booklet valuable to every engineer and contractor. Check the reply card.

Manual on Coatings to Stop Rust

235. Primer type, short oil type, heat resistant, chemical resistant and floor coatings are a few of the items covered. Also complete data on Rust-Oleum products are included. Check the reply card or write Rust-Oleum Corp., Evanston, Ill., for this valuable manual.

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Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, side suction centrifugal pumps and mixed flow pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., Loucks at Dearborn, Aurora, Ill. Included is a pump selection guide and spigot pipe. Check the reply card.

Diesel Engines For Municipal Power Needs

359. Dependable power for water supply or flood control pumping stations, stationary or portable electric plants and many other municipal needs can be provided by engines described in literature of the Enterprise Engine & Machinery Co., 18th & Florida Sts., San Francisco 10, Calif.

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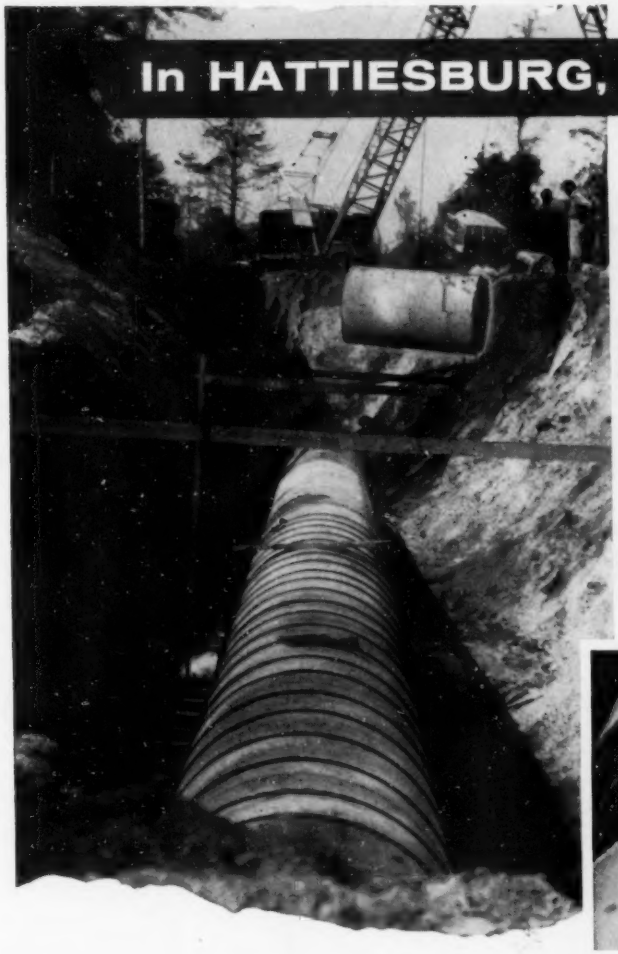

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Directly Readable Flow Charts for Measuring Sewage

380. Recorder gives graphic records of liquid flow directly readable in mgd or gpm over various sizes of Parshall flumes. Check the reply card or write, Leupold & Stevens Instruments, Inc., 4445 N. E. Glesan St., Portland 13, Ore., for Bulletin 24.

Packaged Activated Sludge Plants

408. Packaged sewage treatment plants for small installations utilizing the activated sludge process are covered in Bulletin No. 22579 available from Walker Process Equipment Inc., Aurora, Ill. Check the reply card for design drawings and specifications.

Getting Improved Sludge Dewatering With Non-Clogging Vacuum Filters

425. Latest information on the Komline-Sanderson "Coilfilter," which features non-clogging, permanent filter media to obtain constant output and low operating cost is presented in illustrated Bulletin No. 106 by the Komline-Sanderson Engineering Corp., Peapack, N. J. Be sure to investigate this improved method of sludge dewatering. Check the reply card today.

Valuable Information on Incinerator Stokers

505. The Combustion Engineering stoker is described fully in Catalog No. IS-1 which is available from Combustion Engineering, Inc., Combustion Engineering Bldg., 1132 W. Blackhalk St., Chicago 22, Ill. Schematic drawings of the units, advantages of incineration, firing methods, design and performance are sections covered. Check the reply card today.

Sewage Treatment Engineering Data Manual

511. This manual contains a brief outline of the various accepted methods of treating sewage and some of the problems, advantages and disadvantages of each. Check the reply card or write Smith & Loveless, Inc., P. O. Box 8884, Kansas City 15, Mo., for design notes, charts and drawings.

4-D Wrought Iron for Building Drainage Systems

551. A comprehensive 64-page catalog on piping for soil, waste, vent and downspout applications is available from A. M. Byers Co., P. O. Box 1076, Pittsburgh 30, Pa. Check the reply card for corrosive conditions, typical installation, performance tables and piping economy.

Manual on Solving Drainage Problems

554. A 74-page Manual on the problems of drainage and drainage materials is available. Design section includes determining culvert lengths and sizes, run-off calculations, excavation of base and backfilling data. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for this valuable book.

Small Unit Sewage Treatment For 20 to 5000 People

568. Bulletin 135A describes the Rated-Aeration process, a low cost, odorless, trouble-free sewage treatment process. Check the reply card or write Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill.

Application and Design of Prefabricated Pumping Stations

637. This manual is intended for a guide in designing sewage pumping stations and in explaining the use of prefabricated underground sewage pumping stations. Check the reply card or write to Zimmer & Francescon, 1715 Fifteenth Street Place, Moline, Ill., for your copy.

Dowpac® Applications In Waste Treatment

663. A 32-page bulletin about Dowpac, new plastic trickling filter media contains illustrated information on the product's physical properties, assembly instructions and operational characteristics, including performance data gathered from pilot plant installations. Copies are available from Plastics Merchandising Dept., The Dow Chemical Co., Midland, Mich., or by checking the reply card.

Specifications on Trash-Sewage Pumps

599. Complete specifications, drawings, performance curves and the applications of Gorman-Rupp trash-sewage pumps are covered in literature from The Gorman-Rupp Co., Mansfield, Ohio. Check the reply card.

Press-Seal Rubber Gaskets to Seal Joints of Concrete Pipe Sewers

623. Rubber gaskets for sealing the joints of concrete sewer pipe are described fully in literature available from Press-Seal Corp., P. O. Box 482, Fort Wayne, Ind. Check the reply card for information on how these gaskets prevent water infiltration in sewer lines.

Catalog on Steel Grating

665. New ideas in flooring, walkways, stair treads, platforms and shelving are covered in Catalog 2527R available from Blaw-Knox Co., Dept. W., Pittsburgh 38, Pa. Check the reply card for information on choice of cross bar and bearing bar designs and spacings.

Reinforced Concrete Pipe For Culverts and Sewers

672. Elliptical Lo-Hed and Hi-Hed pipes, round pipe and flat base pipe are described fully in literature from American-Marietta Co., Concrete Products Div., 101 East Ontario St., Chicago 11, Ill. Headwall details, discharge curves, hydraulic capacity tables and hydraulic properties are included. Check the reply card.

Full Line of Sewer Cleaning Equipment

681. Everything for rodding sewers from hand operated equipment to the fully mechanized SeweRodeR. Tools for all types of stoppages are operated by Flexicrome Steel Sewer Rods. Featuring the Truck-Loder which dumps sewer deposits directly into truck, a complete range of Bucket Machines is offered. All equipment is described in 48-page Catalog 55-A. Flexible, Inc., 3786 Durango Ave., Los Angeles 34, Calif.

*THE NAME ORANGEBURG AND THE SILVER BAND ARE REGISTERED TRADE-MARKS OF THE ORANGEBURG MANUFACTURING CO.

Over 300 million feet in use coast to coast!

The test of time has proved the high quality of Orangeburg *Root-Proof* Pipe and Fittings for house sewer lines, downspout run-offs and other underground, non-pressure uses.

Orangeburg's Taperweld Joints seal root-proof and watertight. No leakage, no infiltration. And because it's made of a strong, tough non-metallic material, Orangeburg does not rust. Alternate freezing and thawing... acids and alkalies found in ground water and sewage do not affect it.

All these qualities plus speed, ease and economy of installation have gained for Orangeburg a growing acceptance among leading approving authorities, architects, engineers, builders and plumbers. Today, over 300 million feet of Orangeburg are in service from Maine to California.

The Silver Band* identifies *genuine* Orangeburg: *Root-Proof* Pipe for sewer lines; *Perforated* Pipe for foundation drains, septic tank disposal fields. Orangeburg exceeds requirements Federal Spec. SS-P-356 and Commercial Standard CS 116-54. Write Dept. PW-49 for Engineer's independent report.

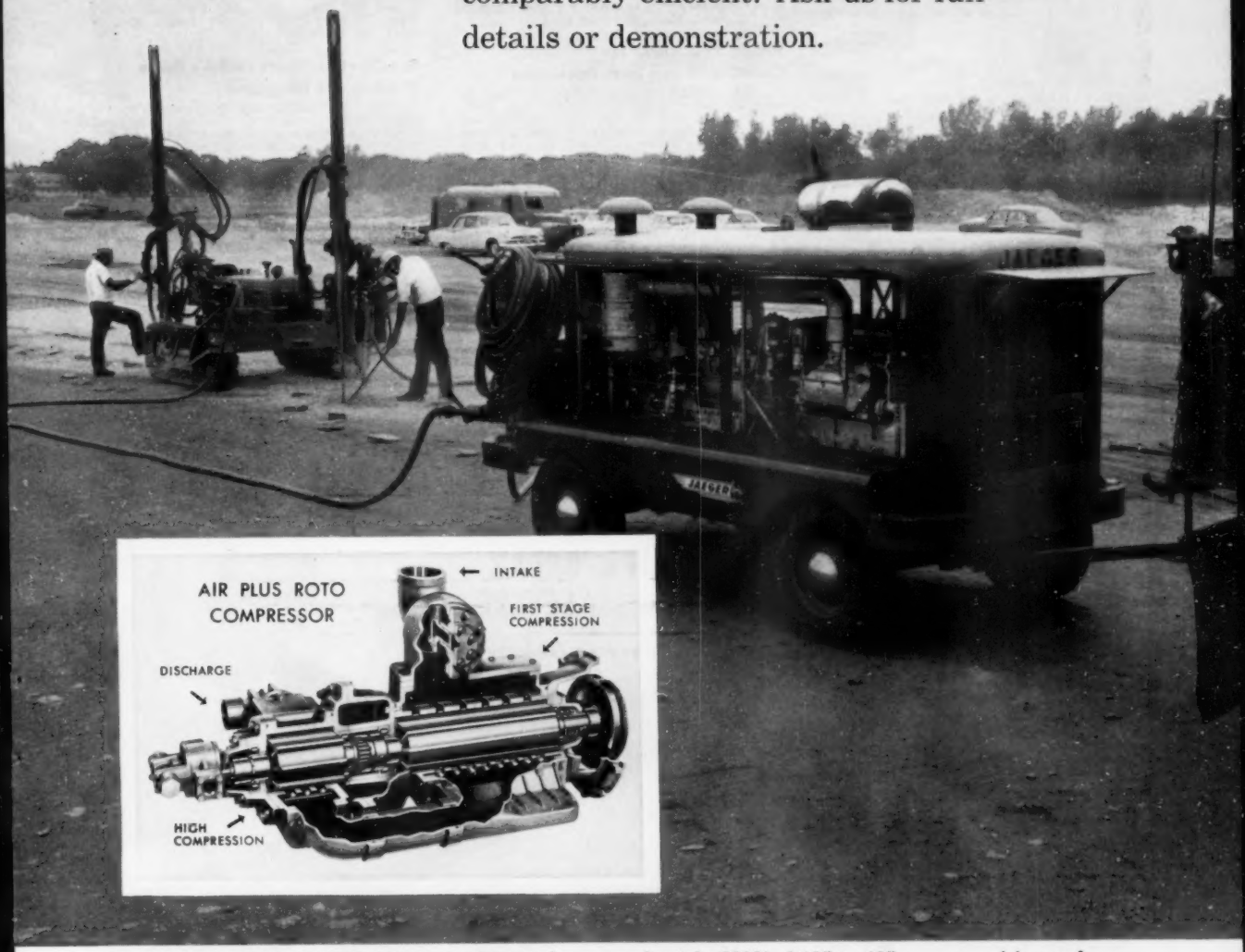
ADVERTISED IN LIFE

ORANGEBURG MANUFACTURING CO.
Orangeburg, N.Y. Newark, Calif.
A Division of The Flintkote Company, Manufacturers of America's Broadest Line of Building Products

genuine ORANGEBURG®
Root-Proof Pipe and Fittings

the pay off

The engine of this Jaeger rotary is the same GM 6-71 diesel used in other "600" compressors. But the Jaeger compressor is so much more efficient it delivers full volume at 100 rpm slower speed (1700 rpm instead of 1800). Think what this means to you in engine life and fuel consumption. Jaeger 125, 250 and 365 rotaries are comparably efficient. Ask us for full details or demonstration.



DRILLING BLAST HOLES ON 3′ CENTERS for approximately 8000′ of 12″ to 42″ sewer requiring rock excavation, at Minneapolis Airport. Holes were 3″, drilled to 9′ depth. Peter Lametti Construction Co., contractor.

THE JAEGER MACHINE COMPANY
400 Dublin Ave., Columbus 16, Ohio

To order these helpful booklets check the reply card opposite page 36.

STREETS AND HIGHWAYS

Foundation Investigation and Pressure Grouting

49. Foundation investigation and pressure grouting and the various miscellaneous services of Sprague & Henwood are described and illustrated in literature from Sprague & Henwood, Inc., Scranton 2, Pa.

Four Wheel Drive 1¼ yd. Front End Loader

115. The Trojan 1¼ yd. loader for heavy-duty bulk materials handling is covered in bulletin available from Contractors Machinery Div., The Yale & Towne Mfg. Co., Batavia, N. Y. Check the reply card.

Complete Line of Wheel Tractors in 6 Power Sizes

179. A 16-page catalog CR-1374-H, that describes the 6 IHC wheel tractors from 12 to 72.5 hp. is available from the Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Special features and specifications for each of these 6 tractors, and a listing of all attachments available.

Rubber Roads Are Now a Reality

230. Ramflex, a free-flowing, devulcanized rubber specially prepared to be used in combination with asphalt for highway paving applications is described in illustrated catalog from U. S. Rubber Reclaiming Co., Inc., P. O. Box 365, Buffalo 5, N. Y. Check the reply card.

Case Utility 310B Backhoe-Loader

282. The Case wheel-mounted backhoe-loader is described and illustrated in 8-page, 3-color Bulletin CUS-110, released from J. I. Case Co., Racine, Wis. Check the reply card for mechanical details of the backhoe, loader and heavy-duty tractor.

Hydra-Drives Power Shift Transmissions

283. With four speeds forward and reverse, the Hydra-Drives is ideally suited for vehicles which must travel in both directions during a normal work cycle. Check the reply card or write Rockwell-Standard Corp., Transmission and Axle Div., Detroit 32, Mich., for full details.

Time-Saver for Transit Set-Ups

291. The Warren-Knight Tele-Plumb enables you to set up over (or under) a point without using a plumb bob, gives full telescope power for easy, accurate positioning. This optical device is attached to the objective end of the transit or transit-level telescope, does not need to be removed during normal use of the instrument. Full details in bulletin from Warren Knight, 136 N. 12th St., Philadelphia 7, Pa.

Manual on the Use of Calcium Chloride

301. This manual presents the physical and chemical properties of the new pellet-type calcium chloride and its water solutions. Also, gives complete data on shipment, handling and storage. Check the reply card or write The Dow Chemical Co., Midland, Mich., for your copy.

Hough Payloaders for City, County and State Operations

323. Hough Payloader Model H-90 can be used on many road construction and maintenance jobs, and its operation, specifications and attachments available are covered in literature from The Frank G. Hough Co., 761 Sunnyside Ave., Libertyville, Ill.

Ultra-Clean Sweeping For Streets, Yards and Airports

499. A new approach to extra-clean sweeping is described in a 4-page illustrated Bulletin (No. 85.55) issued by the G. H. Tennant Co., 755 N. Lilac Drive, Minneapolis 22, Minn. Described is a 7'4" path sweeper that eliminates the use of water for dust control. Check the reply card.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass.

Davis Back-Hoe and Davis Loader

312. Literature is available from Massey-Ferguson Industrial Division, Massey-Harris-Ferguson, Inc., 1009 S. West St., Wichita, Kans., describing the new Davis backhoe and Davis loader. The back-hoe can dig at right angles and to a depth of 13 ft. and detaches in 5 minutes. Both units are available for most popular makes of tractors.

Pre-Assembled Dowel Units For Highway and Airport Construction

537. Laclede dowel assemblies for expansion, contraction and construction joints are precision welded into one unit and are maintained in rigid alinement. For full details write Laclede Steel Co., St. Louis, Mo., or check the reply card today.

Specification Sheets on John Deere Tractors and Equipment

588. Information and specifications on the John Deere crawler and wheel-type industrial tractors and working equipment. Deere & Co., Industrial Division, Moline, Ill. Check the reply card. State type of tractor and equipment.

Vacuum Cleaner and Leaf Collector For Cleaner Streets

595. A unit is now available that can be mounted on a right-hand drive jeep or a pick-up truck for picking up gutter trash and leaves. Complete specifications, capacity, operation and installation procedures are covered in a bulletin available from Tarrant Mfg. Co., Saratoga Springs, N. Y.,

"RAMFLEX RUBBER ROADS don't SPLIT or BREAK even after our SEVERE weather",

says John Zablotny
Supt. of Highways,
Cheektowaga, N. Y.

ANOTHER BUFFALO PRODUCT
RAMFLEX
A SPECIAL RUBBER MATERIAL FOR ROADS, DRIVEWAYS, PARKING AREAS AND ASPHALTIC PAVEMENTS OF ALL TYPES
IDEAL FOR HOT PATCH APPLICATIONS
U.S. RUBBER RECLAIMING CO., INC.
BUFFALO, NEW YORK

"Saves time and labor and gives us better roads.

"In our 200 miles of roads to be maintained we have found Ramflex has definite advantages. It imparts rubberiness to asphalt so that our roads resist splitting in cold weather. Similarly, it makes asphalt less brittle which holds the aggregate firmly in place—thus reducing breaking. Asphalt containing Ramflex does not emulsify and retains its adhesion to the base—moreover, no shoving has been noticed even under heavy traffic conditions." All this adds up to better paving at low cost and practically no maintenance. And—Ramflex Rubber Roads are especially appealling to motoring taxpayers because "when rubber rolls on a rubber road . . . everybody "SAVES".

RAMFLEX is a special rubber powder, developed by the U. S. Rubber Reclaiming Co., and can be purchased in any amount. Ramflex is added directly to the aggregate in pug mill before the asphalt. Can be put down by any competent asphalt contractor and requires no special equipment.

Write for Literature No. 25

U. S. RUBBER RECLAIMING COMPANY, INC.
P.O. BOX 365 BUFFALO 5, N. Y.

PAK-MORs in ACTION
Proud to Serve...
Serving With Pride

Serving New Castle, Delaware

Serving York, Pa.

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Serving S. Charleston, W. Va.

TRUCK EQUIPMENT CORP.

LOCATED 4 MILES WEST OF RICHMOND ON ROUTE U. S. 60

Mailing Address
MIDLOTHIAN TURNPIKE
RICHMOND 25, VIRGINIA

PAK-MOR DISTRIBUTOR FOR Virginia - District of Columbia - Maryland

Chapter
American Public Works Association

Gentlemen:

We sincerely appreciate this opportunity to express ourselves in the following few short paragraphs pertaining to our operation as Distributors of the PAK-MOR Refuse Collection Truck Body.

Our Organization became a manufacturer's agent, representing the PAK-MOR Manufacturing Company of San Antonio, Texas, in 1952.

We distribute the PAK-MOR Refuse Collection Body in the fourteen northeastern states and the District of Columbia, which includes North Carolina, Virginia, Maryland, Delaware, Pennsylvania, New Jersey, New York, West Virginia, Connecticut, Rhode Island, Massachusetts, Vermont, New Hampshire, Maine and the District of Columbia.

We have seven full-time, experienced sales and service men located in the major cities throughout this territory and we also have five distributors; one located in Charleston, West Virginia; Buffalo, New York; one located in Manhasset, Long Island; and Providence, Rhode Island, New Haven, Connecticut;

The representatives in Virginia, Maryland and the District of Columbia are Mr. Stanley H. Suter, and Mr. Robert (Bob) Davis. Mr. Suter has been associated with us for the past six years, and Mr. Davis for the past five years.

Due to the fact that we travel so extensively and the writer is working from time to time in all of the locations in our territory, we feel we are in a position to offer suggestions, help make surveys and help figure costs of collecting refuse and disposing of it.

If at any time our Organization can be of any help to you, please do not hesitate to let us know.

Cordially yours,

Harold L. Cole
President

HLC/jl

PAGE 6 VA.-D. C.-MARYLAND CHAPTER NEWS

Whatever your operation—there's a PAK-MOR (Packer Body or Trailer) designed to do a better job for you. And across the Country, a local Distributor like Truck Equipment Corporation to serve you. Write for complete details.

SANITATION FOR THE NATION

PAK-MOR
MANUFACTURING COMPANY

LOOP 13 & ROOSEVELT AVE.
POST OFFICE BOX 12147
WA 3-4317, SAN ANTONIO, TEXAS

Serving Hyattsville, Md.

Serving Lynchburg, Va.

Serving Hampton, Va.

To order these helpful booklets check the reply card opposite page 36.

Cushman Truckster Hauls an 800 lb. Payload

392. Complete information on the Cushman Truckster is available from Cushman Motors, 1005 No. 21st., Lincoln, Nebr. Features are constant mesh transmission, hydraulic brakes, 12-volt lighting system, etc.

Self-Propelled Ditching Machines

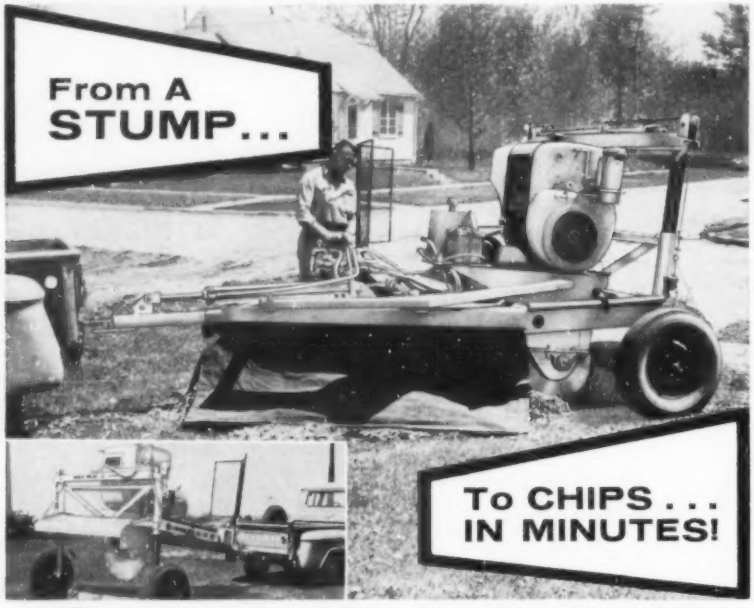
438. Information on a self-propelled one man operated ditching machine, model 524 T, model W-2 and a new midget ditcher, model 4 T, for light construction is now available from the Vermeer Mfg. Co., Pella, Iowa. The Model 524 T digs 8 to 24 inches wide and down to 6 feet deep, while the model 4 T digs 6 to 14 inches wide and down to 4½ feet deep. Model W-2 Ditcher digs from 2" wide up to 4" down to a depth of 30". Full data on these ditchers available by checking the reply card.

Power Tamper for Granular Soil and Bituminous Surfacing Work

342. The Kelley Power Tamper is a self-propelled unit that is equivalent to a 10-ton roller for backfilling, road widening jobs and compacting around culverts and pipeline trenches. For complete specifications write Kelley Machine Div., Wiesner-Rapp Co., Inc., 285 Hinman Ave., Buffalo 23, N. Y., or check the reply card.

IHC Crawler Tractors For Highway Construction

491. Information on the new International TD-6, TD-9, TD-14 and TD-18 diesel crawler tractors is contained in 8-page, 2-color booklets available from Consumer Relations Dept., International Harvester Co., 180 N. Michigan Ave., Chicago 1, Ill. Mechanical features and specifications, engine power, and operation are fully covered.



Vermeer POW-R-STUMP CUTTER

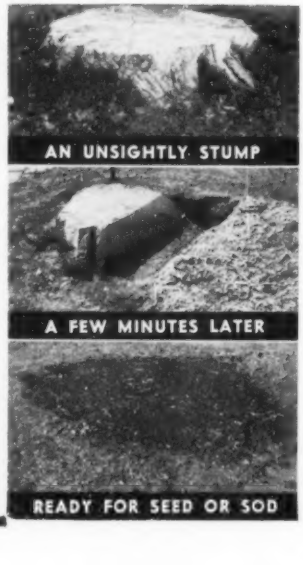
Removes Stumps in Minutes—Not Hours!

Tree Service men and park, recreational and municipal officials all over the country are praising the Vermeer POW-R-STUMP CUTTER. More than an unusual new machine, the Vermeer POW-R-STUMP CUTTER is a revolutionary, new *principle*, that once and for ever has taken the cost, the time and the drudgery of labor out of stump-removal! "From a stump to chips . . . in minutes," is more than a by-word, too, it's a fabulous fact. The Vermeer POW-R-STUMP CUTTER removes the largest tree stump—rips it to shreds to a depth of ten inches below the surface of the ground—all in a matter of minutes. One man, only, is required for the whole operation. And when the job is done there's no stump left to be hauled away, no gaping hole to be filled, no rutted lawns, no damaged curbs, driveways or sidewalks.

This is just part of the remarkable story about the Vermeer POW-R-STUMP CUTTER. To get all the details, write—today—for the colorful new FREE folder, just off the press.

THE ORIGINAL STUMP CUTTER
FIRST & FINEST IN THE FIELD

VERMEER MFG. CO.
1439 W. Washington Pella, Iowa



Construction Methods for Salt Stabilized Roads

609. A comprehensive booklet showing modern methods of salt stabilization is available from the Morton Salt Co., 110 Nr. Wacker Drive., Chicago 6, Ill. Stabilized secondary roads, base courses and shoulders are discussed and all equipment and construction methods are covered. Just check the reply card for your copy.

Warn Lock-O-Matic Hubs Manual

618. Warn Hubs make 4-wheel drive more useful, because they make it into a "free-wheeling" 2-wheel drive, as well as a 4-wheel drive. The Lock-O-matic hubs reduce front end wear, engine load and gear whine. Check the reply card or write Warn Mfg. Co., Riverton Box 6064, Seattle 88, Wash.

Vertical Augers and Horizontal Diggers For Construction Work

644. Prewitt diggers are 2 types, a horizontal boring machine for tunneling work and a vertical rig for pole or post holes, digging up to 6½ ft. Check the reply card or write to J. R. Prewitt and Sons, Inc., Dept. 508, Pleasant Hill, Mo., for full details.

Sweeping Brushes for Road and Sanitation Departments

648. Danline brushes made of round brush wire are easily assembled and require a minimum amount of repair and maintenance. Check the reply card or write Newark Brush Co., 260 Michigan Ave., Kenilworth, N. J., for full details.

Manual on Highway Railings For Bridges and Roadways

660. This manual covers design suggestions, components, specifications for design and construction and the advantages of Alcoa aluminum alloy highway railings. Check the reply card or write Aluminum Company of America, Alcoa Bldg., Pittsburgh 19, Pa., for this valuable manual.

How Good Are Your Truck Drivers? The Tachograph Will Tell You

682. Accurate records of truck engine operation are made available by the Tachograph. Find out how savings and safety can be promoted by getting Bulletin SU-3 from Wagner Electric Corp., 6400 Plymouth Ave., St. Louis 14, Mo. Details of construction and descriptions of operation are included.

Slide Rule PS1 Calculator For Concrete

713. A new pocket size slide rule calculator for the testing of concrete in compression is available from Forney's Inc., P.O. Box 310, New Castle, Pa. It is designed to convert instantly the pressure applied to concrete cylinders and blocks into psi.

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CONSTRUCTION EQUIPMENT AND MATERIALS

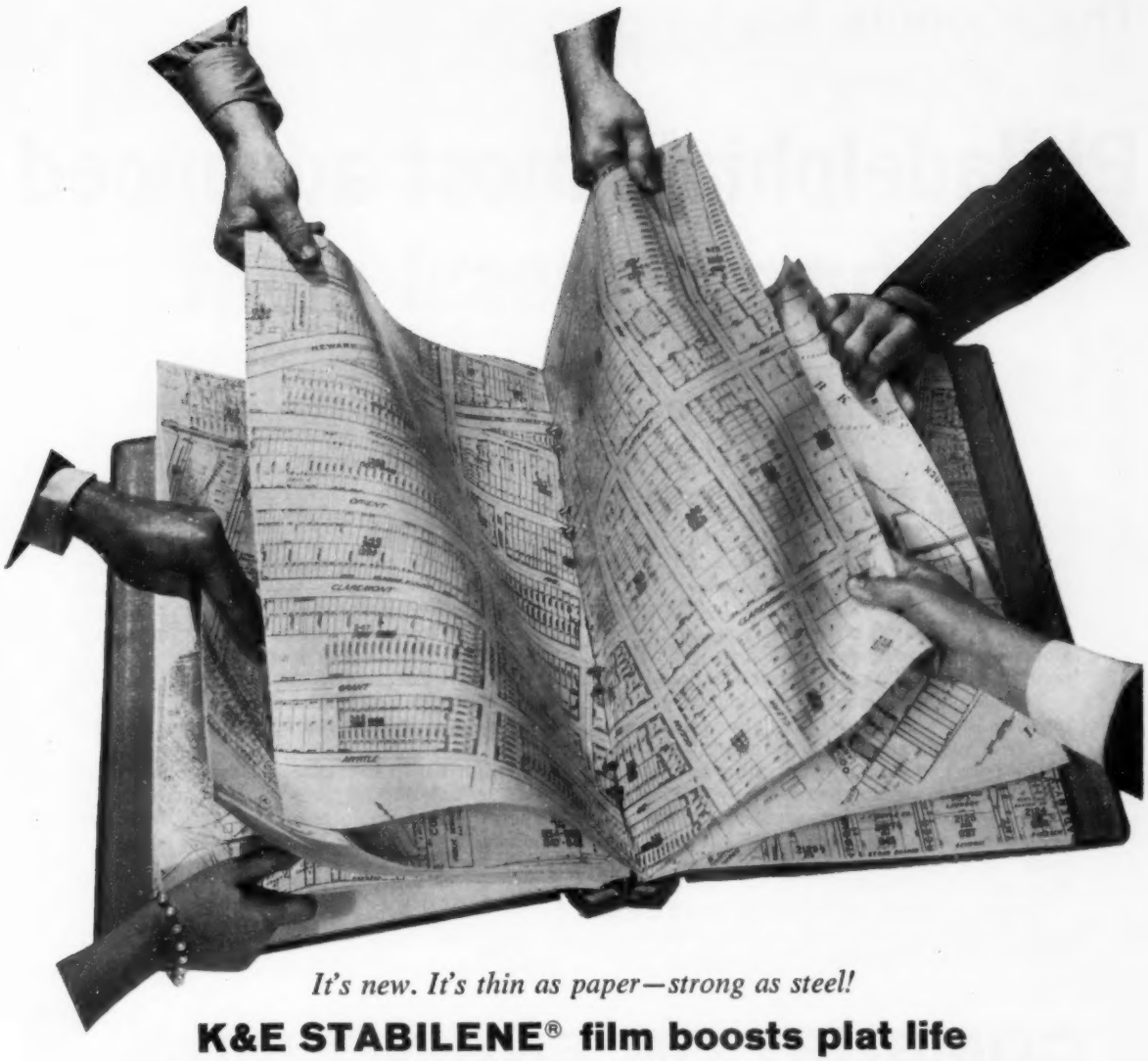
What You Should Know About Air-Placed Concrete

67. For a detailed explanation of the principle of "gunned" or "air-placed" concrete and description of the improved Model 750 and 1250 Bondactors, be sure to get your copy of Form 553 from Air Placement Equipment Co., 1011 W. 24th St., Kansas City 8, Mo. Check the reply card today.

Modern Compaction Methods and Equipment

200. This 52-page Manual covers modern day compaction methods and equipment, rubber-tire rolling, compaction of asphalt mixes, aspects of vibratory compaction, stage compaction on cohesive soils and compaction of asphaltic concrete surfaces. Check the reply card or write Road Machinery Div., Bros Inc., 1057 Tenth Ave., S. E., Minneapolis 14, Minn., for your copy.

(More listings on page 54)



It's new. It's thin as paper—strong as steel!

K&E STABILENE® film boosts plat life up to ten times that of conventional materials...

Never before has there been anything for plats to equal new K&E Stabilene Plat Film. K&E developed it *especially for this purpose.* Plats reproduced on this film stay completely readable, resist ripping or fraying up to 10 times longer than the normal life expectancy of conventional materials.

Here's why! K&E Stabilene Plat Film, on a DuPont Mylar® base, is actually almost impossible to tear. It's so tough and strong that constant handling will not wear it out, pages will not rip from bindings, plats stay new for years.

What's more, unlike conventional materials K&E Stabilene is 100% waterproof; it can be washed with soap and water. It's easy to keep pages free of spots and smudges. Stabilene saves money, too, for it means fewer expensive replacements.

K&E Stabilene Plat Film yields extremely sharp line clarity, great accuracy of reproduction. And the permanent, non-fading image is actually part of the plastic surfacing. It can't be worn or rubbed away.

You can buy K&E Stabilene in rolls, sheets or special sizes to order... in buff, green or white... .005" thickness. It's easy to handle, lies flat or can be rolled for storage or shipment. For details, free samples, mail the coupon today.

KEUFFEL & ESSER CO., Dept. PW-4, Hoboken, N. J.

Please rush me free samples and facts about new K&E Stabilene Plat Film.

Name & Title: _____

Company & Address: _____

_____

1605

The keynote is economy in

Philadelphia's most advanced refuse disposal plant

That's why C-E Incinerator Stokers were specified

In planning its ultra-modern Northwest Incinerator Plant, the City of Philadelphia has recognized the important advantages of continuous operation — through the use of Combustion's traveling grate stokers. Two C-E Stoker Systems are now on order for this plant. Each incinerating furnace employs an inclined drying stoker and a horizontal burning stoker. Each system will be capable of incinerating 300 tons of refuse daily.

Philadelphia's choice of 'continuous processing' over the widely-used 'batch processing' is a matter of sound economics, for every C-E Incinerator Stoker System now operating has service-proved its labor saving and reliability attributes. From the time refuse is deposited into the self-sealing, non-clogging hopper until the residue is ready to be hauled away, only minimum operating attention is needed.

Decontaminated refuse, as it is discharged from the C-E Incinerator Stoker, provides a sanitary, inoffensive fill for reclamation of waste lands, swamps and other recoverable areas.

Where it is desirable to obtain steam for heating, power or process needs, the addition of a boiler to utilize the heat produced by the incinerator provides an exceptionally economical arrangement. Auxiliary oil-firing equipment can be supplied to assure continuity of steam output regardless of incinerator load.

The C-E Incinerator Stoker is designed to handle all types of combustible refuse in quantities ranging upward from 50 tons per 24-hour day.

For further information, please contact the Combustion office in your city, or write directly to Combustion Engineering, Inc., 200 Madison Avenue, New York 16, N. Y.

INDUSTRIAL REFUSE

Get rid of *industrial refuse*, too, with the C-E Incinerator Stoker. Add a Waste Heat Boiler if additional steam is required.

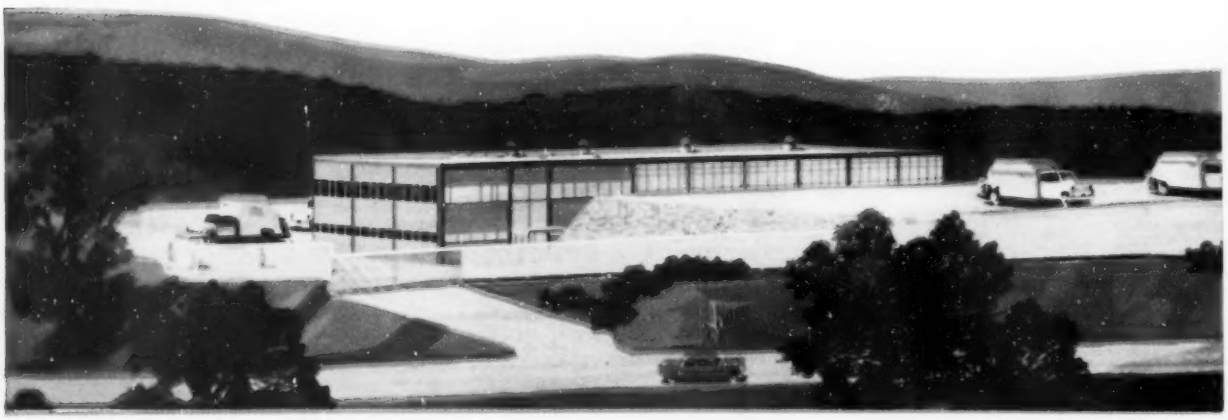
COMBUSTION ENGINEERING

C-E

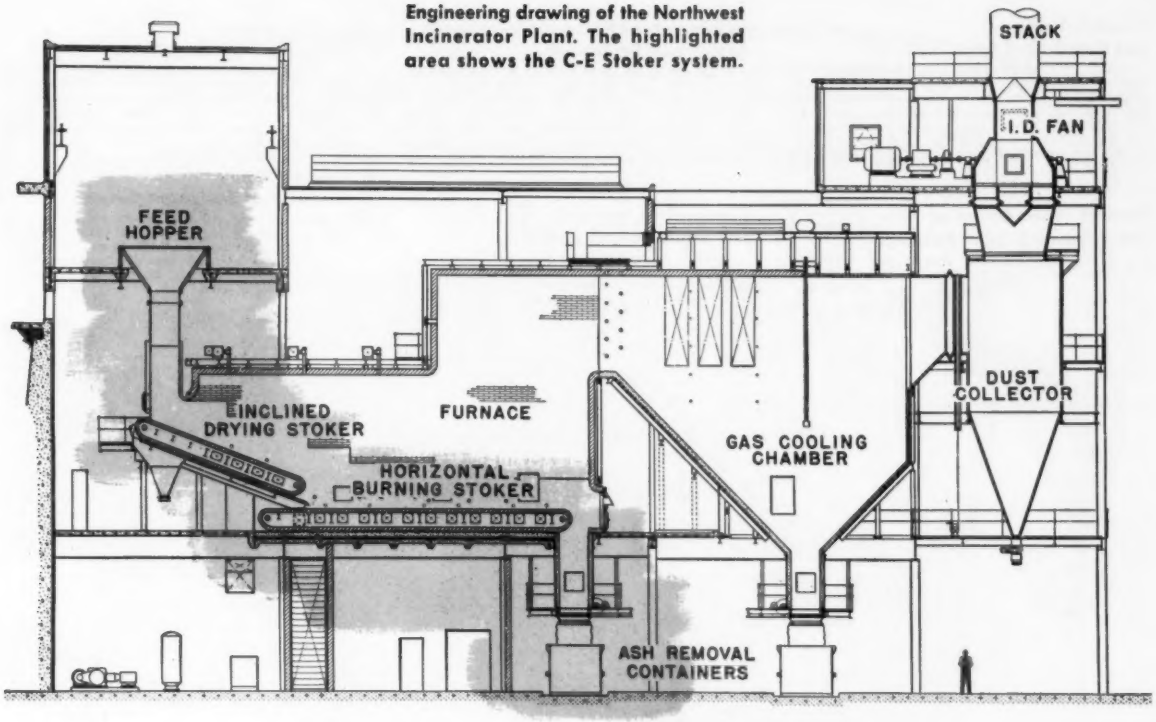
C-176

Combustion Engineering Building • 200 Madison Avenue, New York 16, N. Y.

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT; NUCLEAR REACTORS; PAPER MILL EQUIPMENT; PULVERIZERS; FLASH DRYING SYSTEMS; PRESSURE VESSELS; SOIL PIPE



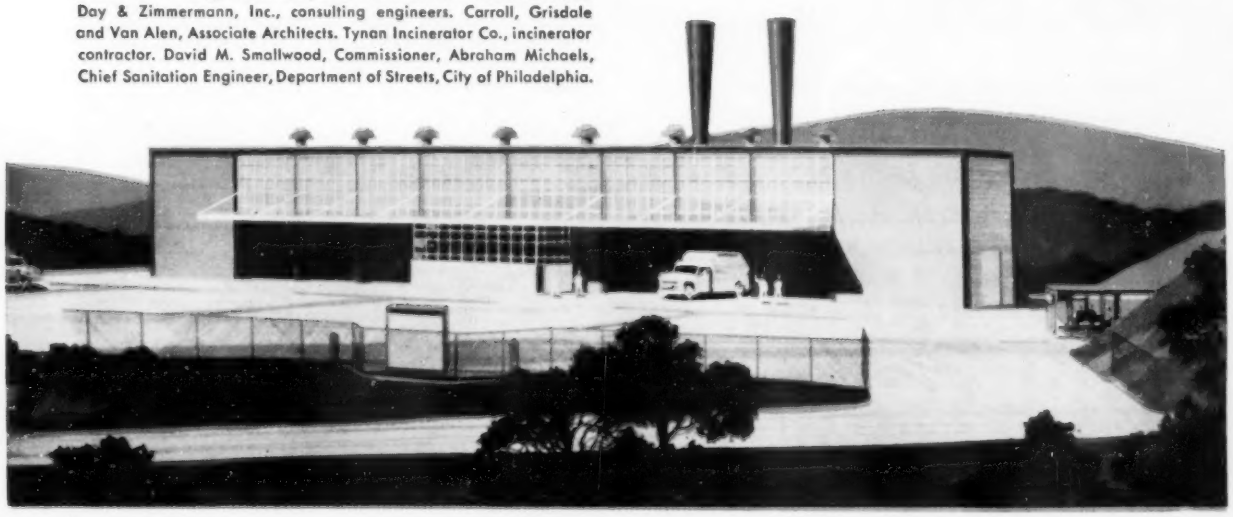
Engineering drawing of the Northwest Incinerator Plant. The highlighted area shows the C-E Stoker system.



HIGHLIGHTS OF C-E DESIGN

- Large hopper and chute provide sealed, continuous supply of refuse.
- Feed of refuse is unobstructed, non-clogging.
- Advance of fuel bed from front to rear is positive, continuous.
- Supply of air to fuel-bed is zone-controlled.
- Residue is discharged continuously from grate surface.
- Operation is easy — no heavy stoking or cleaning of fires.
- Chrome cast iron — most suitable material — is used for grate surface.
- Wide keys over driving chains prevent fouling.
- Grate elements are easily replaceable.
- Steel driving chains take all tension.
- Take-up mechanism is easily accessible at front.
- Maximum availability is assured.
- Stokers are applicable to largest incinerators.
- Less labor is required than with any other burning method.

Architect's drawing of Philadelphia's Northwest Sanitation Facilities. Day & Zimmermann, Inc., consulting engineers. Carroll, Grisdale and Van Alen, Associate Architects. Tynan Incinerator Co., incinerator contractor. David M. Smallwood, Commissioner, Abraham Michaels, Chief Sanitation Engineer, Department of Streets, City of Philadelphia.



To order these helpful booklets check the reply card opposite page 36.

Monthly Time and Cost Record Book

249. To assist owners in determining the cost of owning and operating equipment Caterpillar Tractor Co., News Service, Peoria, Ill., has prepared a 24-page monthly time and cost record book. Twelve sets of pages are included on which to record day by day machine expenses for an entire year. Check the reply card for your copy.

Booklet Shows Design of Pre-Engineered Steel Buildings

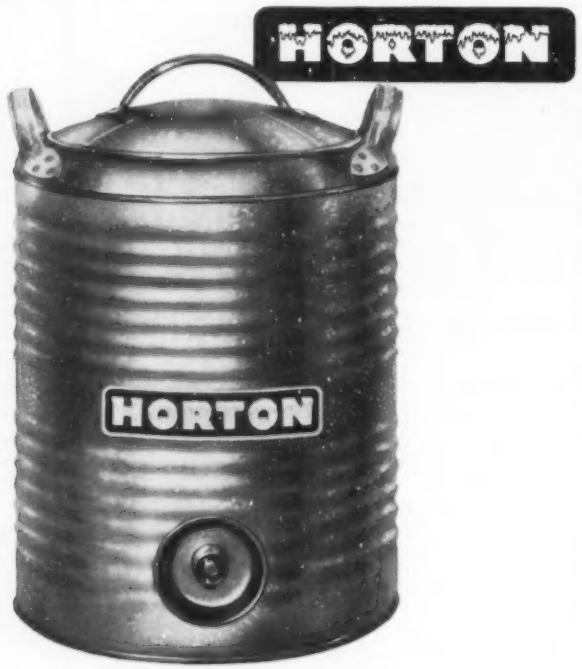
271. Pre-engineered Butler steel buildings are available in every size, type and design to meet your buildings needs. In a helpful 16-page booklet you will find details on several basic designs and an unlimited variety of door, window and interior treatments; answers to your questions on construction and erection; and many illustrations of typical uses. Write to Butler Mfg. Co., Kansas City, Mo.

Catalog on Utility Bodies and Equipment

360. General service bodies, line construction bodies, aerial equipment, winch and derrick equipment and trailers are the units covered in this catalog. For design, dimensions, illustrations and descriptions check the reply card or write McCabe-Powers Auto Body Co., 5900 N. Broadway, St. Louis 15, Mo.

Construction Guide For Engineers and Builders

669. A 34-page four sectioned construction guide containing full-page structural drawings that provide basic information on types, grades and applications of fir plywood for engineers and builders has been released by Douglas Fir Plywood Association, Tacoma 2, Wash. Check the reply card for data on floor construction, single and double wall construction and roof construction.



MORE COOLER for the money!

The Horton Portable Water Cooler is in greater and greater demand in the construction industry. It's packed with value. Check these features: **Rugged, galvanized steel double wall** • Standard dead air space or Heavy Duty Vermiculite insulation • **Purolining, non-toxic inner coating** • Perfect fit lid • **Original recessed spigot** • Riveted, easy-grip handles • **Rounded, sanitary inside bottom** • Solid bottom support • **Complete size range: 1½ gal. thru 30 gal.** • All sizes available with stainless steel liner.

HORTON WATER COOLERS

Distributorships available. Send for literature.

HORTON EQUIPMENT CO. • P. O. Box 2611 • Houston 1, Texas

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air.

Austin-Western Construction Equipment Catalog

260. Power graders, street sweepers, road rollers, crushing and screening plants and hydraulic cranes are covered in catalog from Austin-Western, Construction Equipment Div., Baldwin-Lima-Hamilton Corp., Aurora, Ill. Check the reply card.

From a Stump to Chips in Minutes

303. Pow-R-Stump cutter is operated by one man, handles stumps of any width and up to 33 ins. in height and will not damage curbs, driveways or sidewalks. For literature check the reply card or write Vermeer Mfg. Co., Pella, Ia.

Reference Bulletin Showing Treatment and Correction for Masonry Construction

357. Maintenance problems of masonry construction are covered in this 20-page bulletin from Standard Dry Wall Products Inc., New Eagle, Pa. Check the reply card for this complete and concise bulletin.

Portable Water Coolers Used on Maintenance and Construction Work

651. Igloo cans and coolers are permalined and range in capacity from 2 to 15 gals. Models and sizes are covered in bulletin available from Igloo Corp., P. O. Box 8227, Memphis 4, Tenn., or by checking the reply card.

Basic Fundamentals of High-Speed Earthmoving Techniques

617. This bulletin illustrates and explains the major factors in earthmoving equipment selection. Check the reply card or write the Advertising Division of Caterpillar Tractor Co., Peoria, Ill., for charts and performance characteristics.

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REFUSE COLLECTION AND DISPOSAL

Reduce Your Refuse Disposal Costs

150. A complete line of refuse disposal systems that include containers, giant containers, compaction bodies and compaction trailers are described in literature from Dempster Brothers, Dept. PW, Knoxville 17, Tenn. Check the reply card for data on these efficient systems.

Refuse and Garbage Packer Bodies

241. Ranging in capacity from 12 to 24 cu. yds., the M-B packers have a 30 second compaction cycle and have large side loading doors. Write M-B Corp., New Holstein, Wisc., or check the reply card for bulletin on specifications.

General Specifications for Refuse and Garbage Trailers

251. Two bulletins, one on the Pak-Mor 38 cu. yd. tandem axle trailer unit and the other on the Pak-Mor 32 cu. yd. trailer for use with Model GRD Dempster are available from Pak-Mor Manufacturing Co., Box 6147, San Antonio, Texas. General specifications, power train, operating procedures, maintenance and lubrication and other helpful information are included.

How to Construct A Sanitary Fill

331. A new 12-page booklet which tells the most efficient method of sanitary fill construction and furnishes complete information on planning and operation is now available from Drott Mfg. Corp., Milwaukee 15, Wis. Get your copy by checking the reply card; you'll find this booklet both interesting and valuable.

New King-Sized DUMPMASTER Automatically Collects and Hauls Up To 120 cu. yds. of Refuse per Trip

Shown above is the Dempster-Dumpmaster CA30-24DB model which has a capacity of 100 cubic yards of loose refuse material.

Shown above is the CA15-18DB which has a capacity of 72 cubic yards of loose refuse material.

DEMPSTER BROTHERS' Newest Addition Cuts Waste Disposal Costs

The famous DEMPSTER-DUMPMASTER 24 DB now has a big brother in the CA60-30DB model. Like the original Dumpmaster, it automatically handles detachable containers in one through six cubic yard sizes. However, it can pick up a gross load of 6000 pounds as compared to the 24DB's 3000 pound capacity.

Another important difference in capacity—the new model can compact up to 120 cubic yards of loose refuse while the 24DB gets up to 100 cubic yards per trip. Like all Dumpmasters, the new 30DB has clearance arms for safety . . . they never pass the cab windows . . . can't injure the operator.

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To order these helpful booklets check the reply card opposite page 36.

STREET LIGHTING AND TRAFFIC CONTROL

Investigate These Street Lighting Standards

54. You can get complete data on Kerrigan factory-built "Weldforged" street lighting standards, brackets and mast arms by using the handy reply card. Check these strong, well designed, inexpensive steel standards for practical street and highway lighting. Handsome 26-page folder includes data sheets on floodlighting and area lighting applications. Kerrigan Iron Works, 1033 Herman St., Nashville, Tenn.

Non-Electric Traffic Control Products

156. Reflective pavement marking glass beads, Cataflex "202" reflective coating, Cataline reflective striping, Catatherm reflective plastic striping, plain and reflective street and highway signs, plain and reflective street name signs are covered in literature from Cataphote, Corp., P. O. Box 2066, Jackson, Miss.

Finest Line of Markers for Fine Line Marking

165. Complete information on truck mounted highway markers, self-propelled line markers, all purpose line markers, and hand-propelled line markers is available from the M-B Corporation, New Holstein, Wis. Photographs and specifications of each type of line marker are included. For more, check the handy reply card.

Manual on All Types of Traffic Signs

379. This 26-page manual covers regulatory, warning, school, railroad, street name, road construction, route markers, miscellaneous signs and plastic reflectors. Check the reply card or write The Miro-Flex Co., Inc., 1824 East Second St., Wichita 7, Kans., for your copy.

A Guide to Effective Traffic Safety

468. A 20-page catalog with hundreds of illustrations of all types of signs used on highways and in motor and pedestrian traffic areas is offered to public works officials by Traffic and Street Sign Co., 84 Foundry St., Newark 5, N.J. This convenient reference covers all your sign needs.

Literature on Reflective Glass Beads

690. Glass beads for traffic signs and street name signs are described in literature available from Flex-O-Lite Mfg. Corp., 8305 Flex-O-Lite Drive, P. O. Box 3066 (Affton Br.), St. Louis 23, Mo. Beads can be used on white and yellow signs. Check the reply card.

Use The Reply Card

Electro-Matic PR System Solution to Traffic Signal Problems

474. Data is available on a PR system that is fully interconnected from sampling detectors to local intersection controllers by a choice of radio, 2-wire cable or standard telephone circuitry. Check the reply card or write Automatic Signal Div., Eastern Industries, Norwalk, Conn., for full details.

RECREATION

Heavy Duty Swimming Pool Equipment for Municipal Pools

193. Illustrated bulletin showing heavily built diving and deck equipment is available from American Playground Device Co., Anderson, Ind. Check the reply card for specifications on diving boards, data on diving stands, towers, slides, pool ladders and pool cleaning equipment.

BUSINESS ADMINISTRATION

Stabilene Film for Drafting, Scribing and Reproduction

60. Stabilene film insures accuracy of drawing and reproduction and will last indefinitely. It comes in rolls, sheets or special sizes to order and lies flat or can be curved or rolled. Check the reply card or write Keuffel & Esser Co., Adams and Third Streets, Hoboken, N. J., for complete catalog.

59 Ideas for Modernization in '59

639. Modernizing can start anywhere and it is the purpose of this catalog to point out the many ways that public works departments are finding to modernize or update their operations. Copies are available from Allis-Chalmers Mfg. Co., Industrial News Bureau, Publs. & Ind. Press Dept., Milwaukee 1, Wis.

System For Duplicating and Filing Engineering Drawings

754. The Recordak system for comprehensive filing of engineering drawings is described in literature available from Recordak Corp., 415 Madison Ave., New York 17, N.Y. Drawings are first microfilmed and then they are added to an aperture card for indexing.

INSECT CONTROL

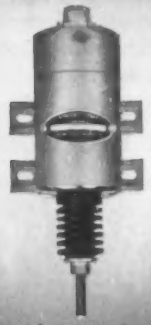
Investigate "Tifa" For Insect Control

47. With "Tifa", the Todd Insecticidal Fog Applicator, chemicals are distributed as a true, clean fog. Use reply card for full data on public health programs. Products Div., Todd Shipyards Corp., Columbia & Halleck Sts., Brooklyn 31, N. Y., Greens Bayou, Houston 15, Texas.

Continuous Duty

D.C. SOLENOIDS with A N CONNECTOR

Synchro-Start MODEL SD-A SOLENOID has an exceptional amount of power over a long stroke with a standard A N Connector. The sealed casing protects this solenoid from seepage of dust and liquids. This solenoid is also available with standard terminal studs instead of the A N Connector (Model SD).



Specifications—SD-A can be furnished in all standard and special voltages up to 115 Volts D.C.

10 lb. pull over 1½ inch stroke.

Power consumption, 550 Watts pulling and 8 Watts holding.

Housing dimensions, 4⅜"x2½".

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HYDRAULIC AERIAL BEAM

Outer beam can be spotted anywhere in a 270° arc . . . inner beam anywhere in a 115° arc. Mast can be rotated continuously in either direction.

Sky-Master gets to out-of-the-way places that can't be reached with conventional aerial equipment . . . saves time . . . saves manpower . . . often eliminates the need for rigging required on many overhead jobs.

With Sky-Master, it's unnecessary to "ground" an experienced man just because his climbing days are over. He can step into Sky-Master's insulated work basket, move the controls, and reach overhead work faster and safer than ever. When controls are released, Sky-Master stops right there—stays right there—until it's purposely moved. Can't creep even if hydraulic lines are damaged.

Sky-Master versatility is yours in one- and two-man models . . . in sizes for reaching from 42′ to 48′ above ground.

Why not send for descriptive literature and prices on both models—today!

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Shattering shale-like material for fast easy loading—with the Drott scarifier attachment for the TD-15 4-in-1. This outfit tends the sanitary fill operated by East Pennsboro Township, Enola, Pa. "This operation calls for a dozer, ripper, clamshell, and loader, and the 4-in-1 with scarifier does the whole job," states Operator Ted Klischer.

With clam lip lifted (hydraulically) this TD-9 4-in-1 becomes an earth-rolling, radius-controlled bulldozer! Owned by Noble County, Oklahoma, the unit is used to build haul roads for rock quarry trucks; remove overburden from deposits of road-surfacing stone; shatter the stone with scarifier; load stone on trucks to surface county roads!

How clam-action 4-in-1 gives

Applying uniform cover on refuse, this TD-9 4-in-1 illustrates exclusive clam action, vital to successful and economical sanitary landfill operation. Unit, owned by Borough of Hanover, Pa., operates a sanitary landfill serving 26,000 people.

Use easily-controlled clam action to fill the 4-in-1 with elusive loose materials (like this crushed stone)—in one fast gulp. And use this quick, stand-and-fill clamshell action for speedy, close-quarters loading!

Working for the Town of Charlottle, N. Y., this TD-9 4-in-1 is clearing brush and trees from right-of-way—helping widen a road for two-lane traffic. See how the 4-in-1 "clams" on to an uprooted sapling, for easy loading and removal!

Exclusive 4-in-1 "concrete-bucking" pry-over-shoe break-out action—breaks up, digs up, and loads out old pavement—gives shovel-like excavating power for many other tough jobs. The new TD-15 4-in-1 exerts 39,200 pounds of break-out force!

"Back-dragging" borrow material down by the truck-load, this new 2¼ cu. yd. TD-15 4-in-1 shows a popular (and exclusive) method of producing refuse "cover" for the sanitary landfill—or street-surfacing materials, wholesale. This same action can be used to clean or reshape ditch banks.

your city a BIG-CAPACITY "one-man equipment fleet"

with instant changeovers; versatility unlimited... all for one moderate investment!

Simply move the selector lever from the operator's seat—stopped, or on-the-go—and get your choice of machine actions to do an unlimited variety of cost-cutting operations! City and county officials everywhere are proving the exclusive 4-in-1 deserves to be called the "40-in-1," because of the endless types of specialized outfits it can replace!

Your clam-action 4-in-1 can demolish and load-out unwanted pavement, curbings, or sidewalks—clear land and rough out new streets—install culverts with "mass-production" speed—build reservoirs, level land and landscape. It can give amazingly low costs, producing and loading street surfacing materials from pit or bank, and can spread them accurately.

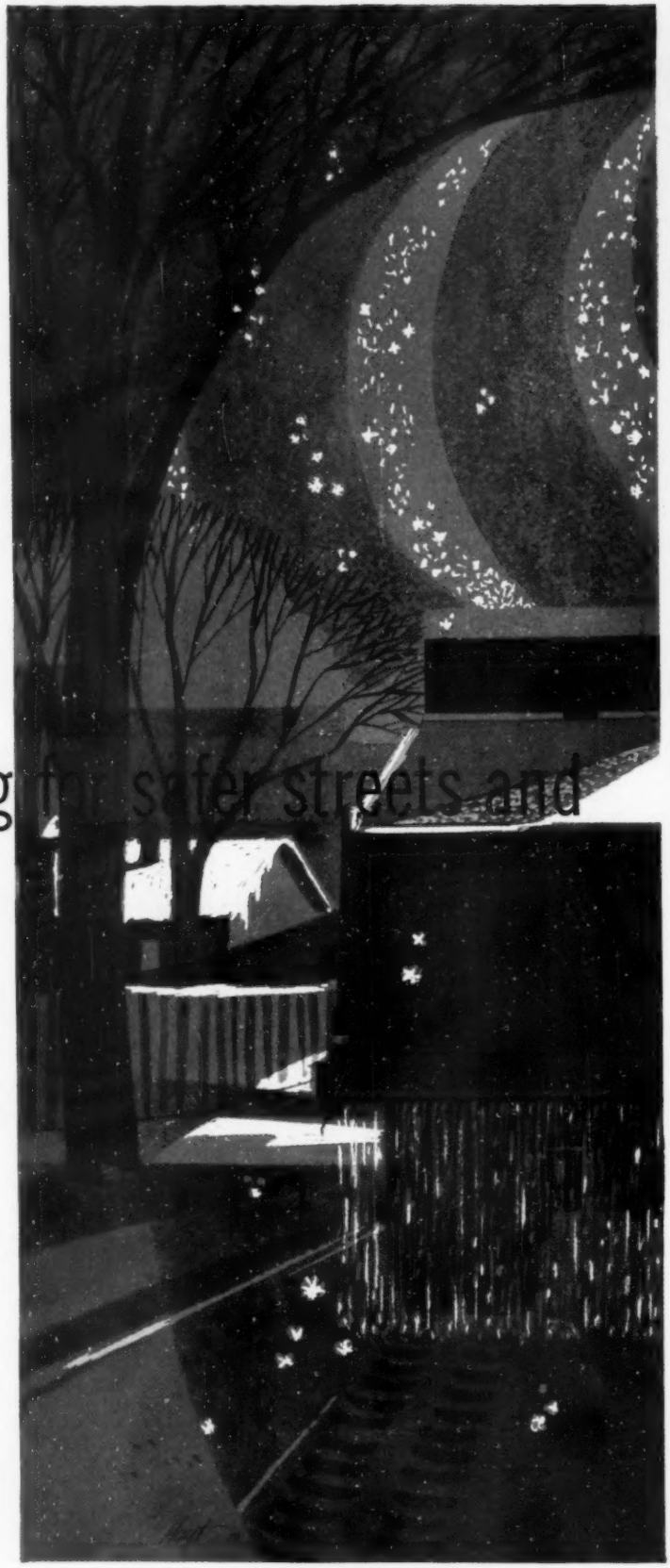
This one-man-operated "equipment fleet" can give you power-shovel-like digging force for tough excavating, or can grade or strip with inch-close accuracy. And able to "double" for four big-capacity machines, at a fingertip nudge, the exclusive clam-action 4-in-1 handles the whole shebang of sanitary landfill jobs—with the efficiency and economy to leave old-style single-action loaders with their buckets dragging!

See what one moderate investment can buy your city in multiplied usefulness—in big-capacity versatility unlimited—in an International Drott 4-in-1. Prove what it means to have instantly available in one heavy-duty machine, under one operator's control, the full-sized performance of bulldozer, "carry-type scraper," Skid-Shovel, and clamshell. Compare the performance and long life protection of exclusive shock-swallowing Hydro-Spring. See your International Drott Distributor for a 4-in-1 demonstration!

International Harvester Company, Chicago 1, Illinois
Drott Manufacturing Corp., Milwaukee 15, Wisconsin

INTERNATIONAL® DROTT®

Now use Morton Rock Salt all year long for safer streets and

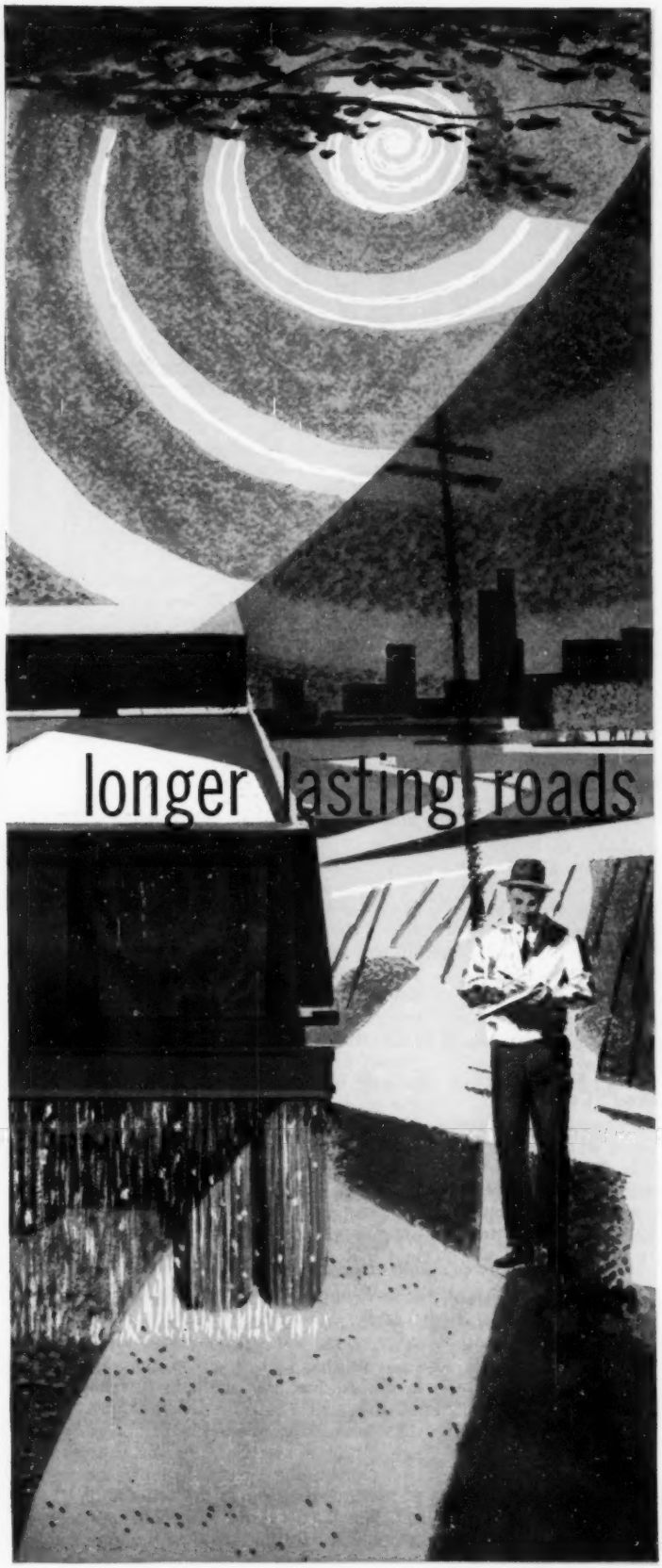


The best, most economical way to help keep your streets safe during winter months is to use straight Morton Rock Salt.

Straight Morton Rock Salt gives **abrasive traction** against skidding before it starts to melt the ice. Morton Rock Salt crystals are larger than other commonly used ice melting chemicals and **penetrate ice deeper** with a corkscrew action—not just melt surface ice. This better penetration means Morton Rock Salt reaches the pavement fast and quickly **melts** the bond between ice and street surface.

Morton Rock Salt is safe, clean, economical

Straight Morton Rock Salt is non-toxic. It does not damage animals' paws, rubber, fabrics, leather, asphalt, brick or properly seasoned concrete. It will not clog sewers or leave a rutted, dirty pavement as will sand and cinders. What's more, Rock Salt **melts more ice at lower cost** at any temperature above 8° F. than any other commonly used ice melting chemical.



You reduce aggregate loss, save man-hours and maintenance costs when you stabilize your roads with Morton Rock Salt.

Secondary roads stabilized with Morton Salt give more service per dollar than roads built by any other method—and the savings in aggregate alone more than pay for the salt. You get smooth, durable, water-repellent surfaces that require minimum maintenance.

Stabilizing the base course of primary roads with Morton Rock Salt helps prevent the 9 out of 10 road failures which result from faulty foundations.

Stabilizing shoulders with Morton Rock Salt not only checks erosion and rutting, it reduces dust and eliminates accidents caused by soft shoulders. You also save on grass and weed removal.

Road stabilization ends problem of winter salt carry-over

The proven value of salt stabilized roads means city, county and state highway officials no longer have the problem of how much rock salt to order for ice and snow removal. Now you can order an adequate amount of rock salt for winter protection. If you have a milder winter than anticipated, the extra rock salt can be put to excellent use for summer road stabilization projects.

Mail coupon today!

I would like free additional information about the advantages of using Morton Rock Salt for both ice and snow removal and stabilizing roads.

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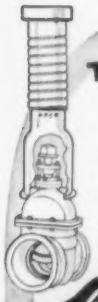

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sliding or screw type cast iron valve boxes for covering 4" thru 10" valves for water or gas. Rugged construction for lifetime service. 5¼" shaft. Extensions as required.

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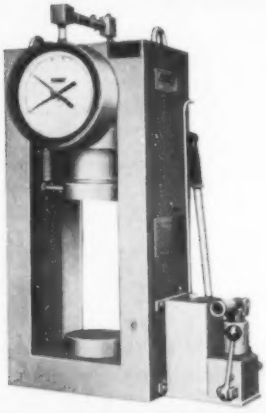

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LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

At the Old Ball Game

Penix v. City of St. Johns, 92 N. W. (2d) 322, a Michigan case decided Oct 13, 1958, was an action against the city for injuries sustained by the plaintiff when bleachers in a municipal park gave away during a ball game.

The plaintiff claimed that the collapse of the bleachers was due to a defect in erecting the bleachers or in keeping them in repair, and that as a result of the defect the bleachers gave away, causing the plaintiff to fall to the ground, first striking her head against another board during her descent. The injury caused her to be invalided for a period of several months.

The Supreme Court of Michigan held that the city was not liable for negligence in such a case, because it was a governmental activity, rendering the city immune from liability for negligence.

There is a split of authority, among the various jurisdictions, on the general question of whether the maintenance of public parks is governmental or proprietary.

"Parked" Car

Another problem involving public parks was presented in *Pietz v. City of Oskaloosa*, 92 N. W. (2d) 577, an Iowa case decided Oct. 14, 1958.

The plaintiff was injured while seated in a parked car, when a tree standing in the public park fell upon the car.

He brought an action against the city for injuries thus sustained, basing his action on the statutory duty of a city of keeping its streets in a safe condition.

Under the statute, there would be liability if the city were negligent. The cases in point, under similar statutes, have held that a city is liable for injuries to travelers resulting from the fall of a tree growing on or overhanging the street or way, provided it has actual or constructive notice of its dangerous condition and failed to take proper measures to remove it. Thus, a question of fact was presented in this case: Did the city have actual or constructive notice of the dangerous condition of the tree?

The tree in question was an ash, located in the park 25 feet west of where the car was parked. It was 2 feet in diameter at the butt and 50 feet in height. It was a live tree. On the day in question, an unusually strong wind was blowing, with gusts up to 65 miles per hour. The entire top of the tree broke off at a place 28 feet above the ground, splitting the trunk down 15 feet before it broke clear. After the break, no limbs or branches remained on the stump left standing. There was testimony, based on an examination of the broken part of the tree, that it was decayed at the place of the break and was deteriorated. However, there was no outward appearance, prior to the break, that the tree was decayed or in any way unsafe. A few months before, a competent firm of tree repairmen, employed by the city, had inspected the trees in the park, including the one in question and reported it to be in good condition.

The court held that, under these circumstances, there was no evidence of negligence by the city, or of the maintenance of a nuisance, and hence no cause of action.

Plugged Sewer Manhole

Mulloy v. Sharp Park Sanitary District, 330 P. (2d) 441, a California case decided Oct. 21, 1958, was an action against the sanitary district for damages resulting when plaintiff's home was flooded with sewer water and debris because the district's manhole was plugged. The water entered through the toilet and bathtub, flooding the bathroom and other rooms in the house with about four inches of water and debris.

Spend one day with a Hydro E-Z Pack and you'll see ways to save many dollars on any waste disposal operation.

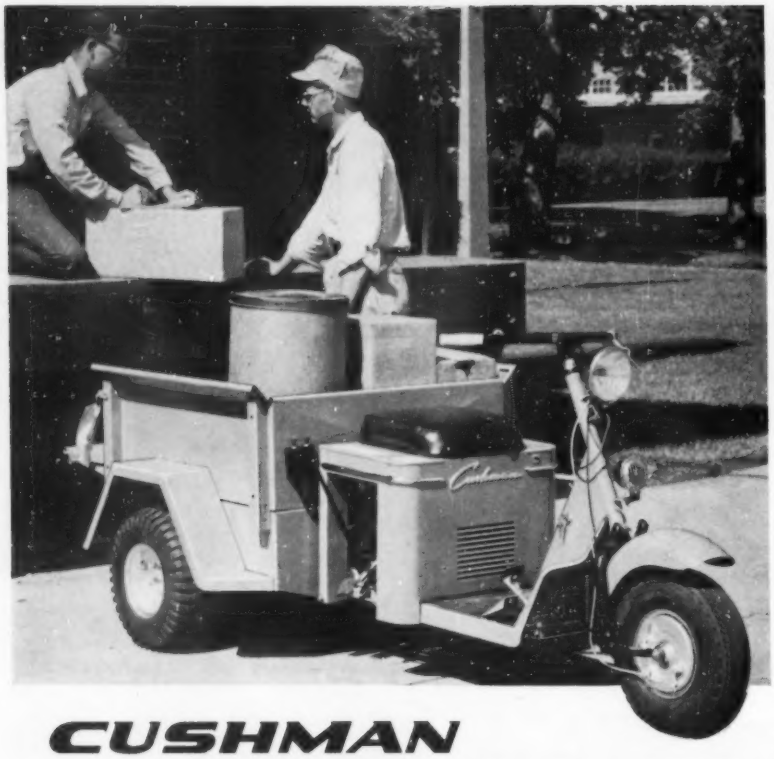
You'll have to believe a demonstration of Hydro E-Z Pack right on your own route, won't you? You'll see how one unit hauls all types of waste—garbage, trash, tree limbs, etc.—on commercial, residential, suburban and mixed routes. You'll see how E-Z Pack requires fewer men, makes more stops in less time, makes fewer trips to the dump and unloads faster. You'll see just why E-Z Pack requires a smaller-sized chassis than most packers, thus cutting initial investment, operating and maintenance costs. Then, you'll start figuring how much Hydro E-Z Pack can be saving you (or adding to your profits, if waste disposal is your business).

If a demonstration can prove all this (and not obligate you in any way), don't you think it would be wise to ask for one? Do so by writing us. We'll help arrange a seeing-is-believing demonstration and send a free copy of "The Big Squeeze."

Hydro E-Z PACK

HYDRO E-Z PACK

HYDRO E-Z PACK DIVISION OF HERCULES PRODUCTS, INC., DEPT. PW 459, GALION, OHIO



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Thousands of users have proved it. This rugged, versatile vehicle powered by the Cushman Husky 4-cycle engine handles an 800 pound payload at amazingly low cost (less than a penny per mile) and stops the dollar drain of conventional equipment used on light hauling jobs.

New 1959 models incorporate no less than a dozen important advances for improved performance, safety and ease of operation. They include:

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The District's records indicated that the manhole in front of plaintiff's home was inspected the day before, and no obstruction of the sewer was seen at that time. However, it was found to be plugged at the time of the incident in question.

The defendant's defenses were: (1) It was immune from liability, because this was a governmental activity, and (2) that there was insufficient evidence of its negligence, in any event, to go to the jury.

The court held, however, that neither of these contentions were valid. The Sanitary District was held liable for creating and maintaining a nuisance.

City Dump

Gonzalez v. City of El Paso, 316 S.W. (2d) 176, a Texas case decided May 28, 1958, was an action by a mother against the city for the death of her son who was shot by a policeman at the city dump while the latter was engaged in guarding the dump from trespassers.

Although the city had contracts with several individuals, allowing them to pick up salvage from the city dump, for which they paid some compensation, the operation of the dump by the city was nevertheless held to be in a governmental capacity. Thus, the City was immune from liability for the acts of its agents.

• • •

High Rate Filtration

The end of 1957 completed nearly 10 years of experimentation by Chicago on the operation of filters at rates of filtration in excess of two gallons per minute per square foot of filter surface. Some of the important facts brought out by the investigation are:

1. The Lake Michigan water at Chicago may be filtered at a rate of 5 gallons per minute per square foot of filter surface with no impairment of bacteriological quality.
2. The length of filter run is almost inversely proportional to the rate. A filter operated at 4 gpm will run approximately one-half as long as one operated at 2 gpm.
3. The filter performance (volume of water filtered per 1-ft. increase in loss of head) is greater for the high rate filters than for those operated at a 2 gpm rate.
4. Turbidity of the filtered water at high rates of filtration is approximately the same as the 2 gallon rate.

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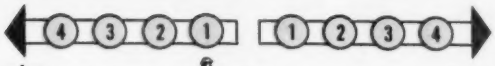
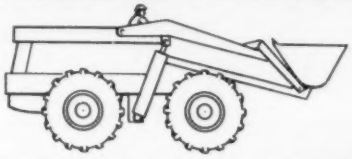
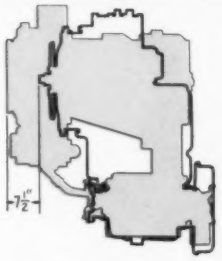
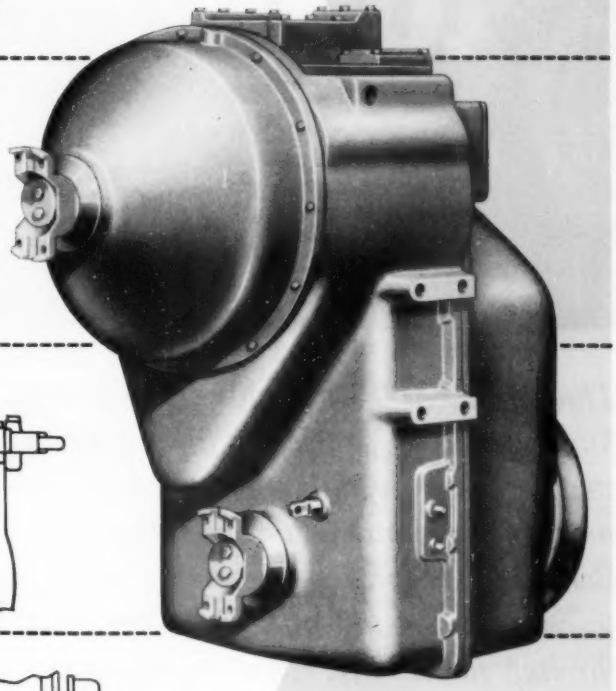


1. **4 speeds forward and reverse.** All power shifted! Provides maximum horsepower to load under all load conditions.

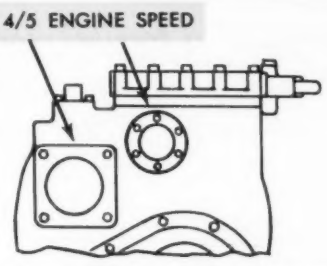


2. **Integral design.** Torque converter, transmission, oil passages, valving and oil sump are in *one* compact housing—7½" shorter than comparable models.

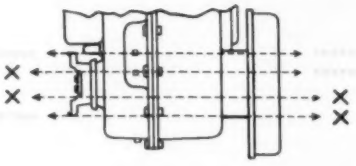




3. **Dual reduced speed pump drives.** Pumps can be driven at engine speed or ⅘ engine speed for longer life and increased horsepower to pump load. Single pump drive is also available.



4. **Full disconnect** provides four combinations of split drive . . . from torque on both shafts, to both shafts in disconnect.



SPECIALLY DESIGNED FOR SMALLER INSTALLATIONS

Rockwell-Standard's new model Hydra-Drives Full Power Shift Transmission is now available in sizes especially designed for smaller installations, such as front end loaders, fork trucks, scrapers, crane carriers, rubber tire tractors and military vehicles.

In addition, the Hydra-Drives BDB offers easier servicing and maintenance. There are fewer moving parts and bearings. The simple, rugged countershaft design and spur gears simplify maintenance.

HYDRA DRIVES
ROCKWELL-STANDARD CORPORATION
TRANSMISSION AND AXLE DIVISION
DETROIT 32, MICHIGAN

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Chevy power is tough—

and proves it on bruising off-the-road hauls!

That Series 100 Chevy tandem above takes a terrific pounding as it hauls huge loads of gravel or fill dirt into the heart of California's redwood country. It goes miles off the road, makes up to 24 trips a day through rocky forest land. Yet owner Bernard Conti, of the Conti Sand & Gravel Company, reports only one hour of downtime in 20,000 miles on this truck-killing road construction job. And Chevy's tough power gets the truck through faster, Mr. Conti says; assures more trips—more profits—per day!

Hauling outsized loads of fill dirt through California's forests calls for a heavy-duty truck that's rock-rugged and powerful as they come; one that's soundly built down to the last bolt. And the Conti Sand & Gravel Company bears witness to the fact that Chevrolet is just such a truck. They're completely satisfied with their Series 100 model, from the dependable pulling power of the big 230-h.p. Workmaster V8 to the work-whipping qualities of the tough-built chassis components. And you'll be equally satisfied with whichever Chevy heavyweight or middleweight *your* work requires!

Mr. Conti indicates that Chevrolet's Powermatic* transmission is of special importance in this rugged service. It helps him to bull through the tough spots with exceptional ease. This fully automatic 6-speed transmission virtually eliminates manual gearshifting! It also provides a Hydraulic Retarder that helps you control truck speed and saves wear on the service brakes.

**Optional at extra cost, Series 50, 60, 70, 80, 90 and 100 models.*

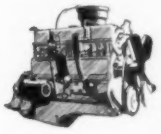
No job's too tough for a

Chevy's powered to cut costs and keep going on your tough off-the-road hauls!

That's for *sure*, whether you use mighty middleweights or high-capacity heavyweights—whether you prefer V8's or 6's.

Take Chevrolet's 1959 big-truck V8's, for example. As indicated by that tough truck job pictured above, these modern engines are out to whip any work that comes their way. They've got what it takes to do it. The *shortest piston stroke* of any comparable truck V8's: a sure sign of more work on less fuel. Compact design that cuts down on truck weight and helps assure the biggest possible payloads. Scores of up-to-the-minute features that know how to trim overhead: full-flow oil filter, hydraulic valve lifters, hard-faced exhaust valves and hardened valve seats, extreme-duty Moraine 400 bearings, rotor-controlled governor, overspeed warning light and many more.

And with a *complete* lineup of modern V8 powerplants—including 160-h.p. Trademaster, 160-h.p. HD Taskmaster, 175-h.p. HD Super Taskmaster, 185-h.p. Workmaster Special and 230-h.p. Workmaster—Chevy can match the engine to your work, ideally.



Or if you prefer 6's, Chevy's *still* your best bet. Standard in Series 40 models is the 135-h.p. Thriftmaster 6, better than ever for '59 with a new Economy-Contoured camshaft that improves gas economy by 10%! And in Series 60 there's a new edition of the 150-h.p. Jobmaster 6. It offers new durability stemming from new tougher built pistons and Stellite-faced exhaust valves. Both of these famous 6's provide plenty of hard-pulling torque.

Six or V8, you'll go a long way before you see the likes of this '59 Chevy engine lineup. Actually, there's only one *best place* to go for all your trucking needs—and that's to your Chevrolet dealer's. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

Chevrolet truck!

CHEVROLET

Public Works Officials in Many Cities, Counties, States and Provinces

MAKE BUDGET DOLLARS DO MORE WITH AIRPLACO CONCRETE GUNNING EQUIPMENT

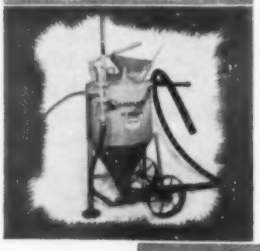
When the Job Calls for Concrete . . . Call for AIRPLACO

AIRPLACO CONCRETE GUNS for Restoration and Repair of Roads, Streets, Bridges, Culverts, etc. Choose from six different models in a complete line of concrete guns. Whatever your production requirements—from ½ to 8 cu. yds. per hour—there is an AIRPLACO BONDACTOR or NUCRETOR to meet your needs.

AIRPLACO MIX-ELVATORS for Faster, Easier Proportioning, Mixing, Elevating and Screening. Choose from three models. Capacity up to 12 yds. per hour.

AIRPLACO GROUTER AND PLACER for Easy-to-Use, Versatile Grouting and Placing of Concrete and Other Materials.

The portable Model G-6 Grouter and CP-10 Placer is ideal for soil stabilization, tunnel backfilling, filling hard to get to forms, etc. Both the G-6 and CP-10 have capacities of up to 5 cu. yds. or more depending on materials used and job conditions.



AIRPLACO JET-BLASTERS For Low-Cost, Easy-to-Use Sandblasting (wet or dry). The Model B-6 single charge (650-lb. capacity) and B-3C continuous feed (500-lb. capacity) Jet-Blasters are designed to handle all abrasive materials for cleaning, polishing, or etching of any type of surface. Jet-Blasters are available with accessories for wet or dry blasting and new exclusive "Sand-Saver" remote cut-off valve.

Let Us Help You Solve Your Concrete Problems

Our experience in solving unique problems involving the handling of concrete has saved thousands of dollars for others. This experience is available to you. Write, wire or phone us, anytime.

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1013 WEST 24TH ST. • KANSAS CITY 8, MO.

WORLD'S LEADING MANUFACTURER OF "ADVANCED DESIGN" PNEUMATIC PLACING EQUIPMENT

LETTERS TO THE EDITOR

HICKAM FIELD WATER TANK

I have read with considerable interest the article concerning the Hickam Air Force Base, Hawaii, water tank written by Charles Moore, Pacific Air Base Command and titled "Water Tank Conforms to Airfield Structure," which appeared in the February 1959 issue of Public Works Magazine.

I was employed at Hickam Field in the office of the Constructing Quartermaster as Associate Architect in 1937 when the tower was designed and constructed, and I wrote the specifications for it. The "Young Quartermaster Captain" mentioned in the article was Captain H. B. Nurse, Q.M.C., now Colonel H. B. Nurse, USA (Ret), living in San Francisco. The architectural design is the work of Mr. Van Oort of Honolulu, Hawaii, who was an employee of the Constructing Quartermaster at the time.

Hal P. Spencer
Chief Engineer
Reese Air Force Base
Texas

Ed. Note—We thank Mr. Spencer for his interesting note bringing back recollections of a different era.

CONCRETE PAVEMENTS FOR CITY STREETS

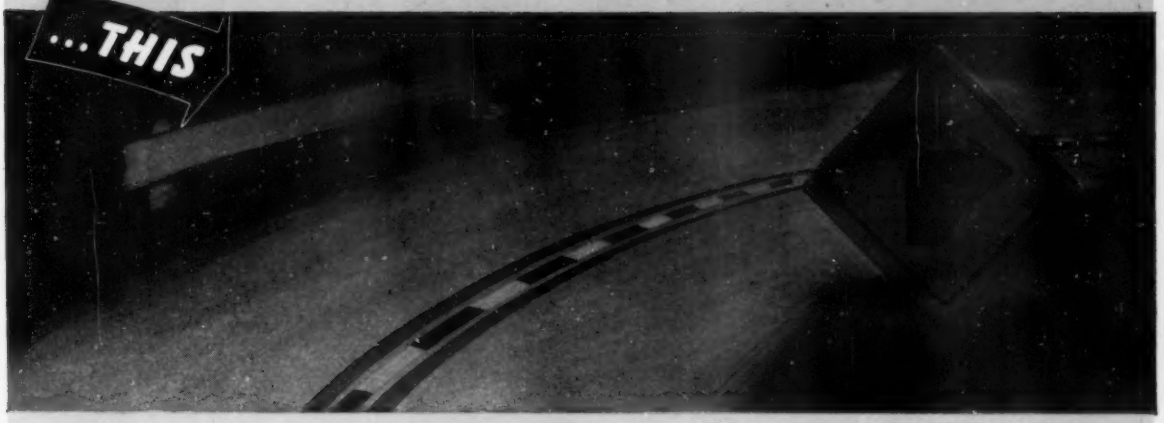
In his article "Concrete Pavements for City Streets" (January 1959), Harold F. Clemmer voices his views on concrete sawing. They are certainly not supported by those of practically all State Highway Departments, the Corps of Engineers, the Portland Cement Association, and many contractors.

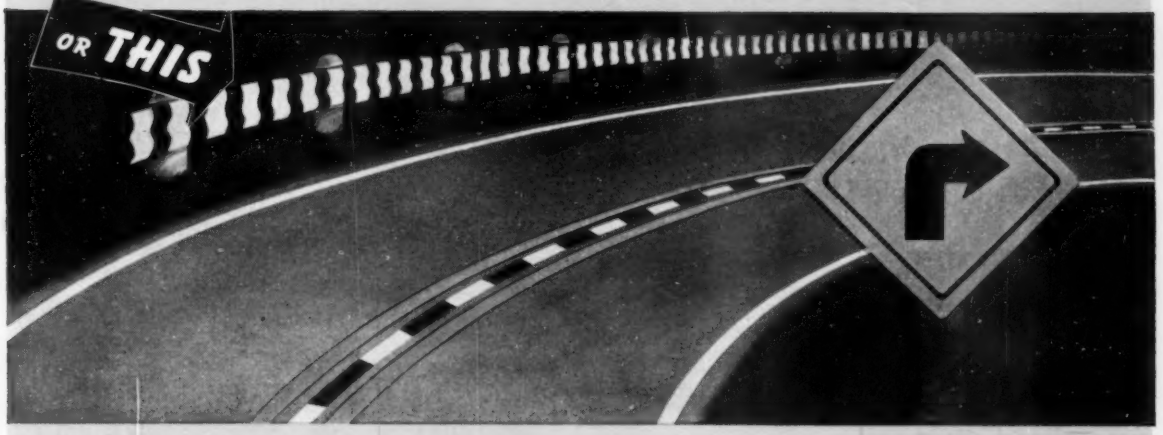
To quote just two authorities:

The Corps of Engineers, Ohio River Division Laboratories, concluded after an extensive survey of nine different installations: "The sawing of contraction joints in airfield pavements is a practical and desirable method of constructing these joints."

The Kansas Highway Commission states: "We have found no dissent-

DO YOUR TRAFFIC SIGNS LOOK LIKE...





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LEAD-FREE REFLECTIVE GLASS BEADS COULD MEAN THE DIFFERENCE

Signs employing the finest reflective materials are adversely affected in a number of ways, such as by moisture, thermal changes and dirt . . . as well as acts of vandalism, accidental breakage and normal wear and tear. Further, the sulphides in industrial fumes attack glass beads containing lead, causing them to turn dark, with a consequent loss of their reflectiveness and visibility. Maintaining adequate visibility through fair weather and foul for maximum safety is a *must*. To ignore this fact is bargaining with lives. So, it is just common sense to buy lead-free beads that won't turn dark. That's why street and highway engineers specify Flex-O-Lite Lead-Free Reflective Glass Beads —with full confidence in their maximum brilliance and lasting reflectivity throughout a longer life. Specify the beads proved best by test. Insist on Flex-O-Lite Lead-Free Reflective Glass Beads. Write for free, informative brochure.

- **#831 REFLECTIVE GLASS BEADS**—Best for white and yellow signs. Meet and exceed all test requirements . . . microscopic, acid, sodium sulphide, spherical content, gradation.
- **FREE-FLOWING REFLECTIVE GLASS BEADS**—Won't agglomerate. Contain no injurious waxes, oils or resins. Offer perfect adhesion to any suitable traffic bead binder. Economical.
- **TYPE H SAFETY SPHERES**—Approximately fifteen times brighter than standard highway beads. For reflectorizing guard rails, curves, bridge abutments, safety islands, etc. Offer maximum reflectivity at lowest cost.
- **FLEX-O-LITE FREE-FLOWING TRAFFIC LINE BEAD DISPENSER**—New, simplified. Affords years of trouble-free operation. Ideal for municipal and highway use. Attaches to any traffic line paint machine. Satisfaction guaranteed.
- Ask about our Sign Bead Applicator.

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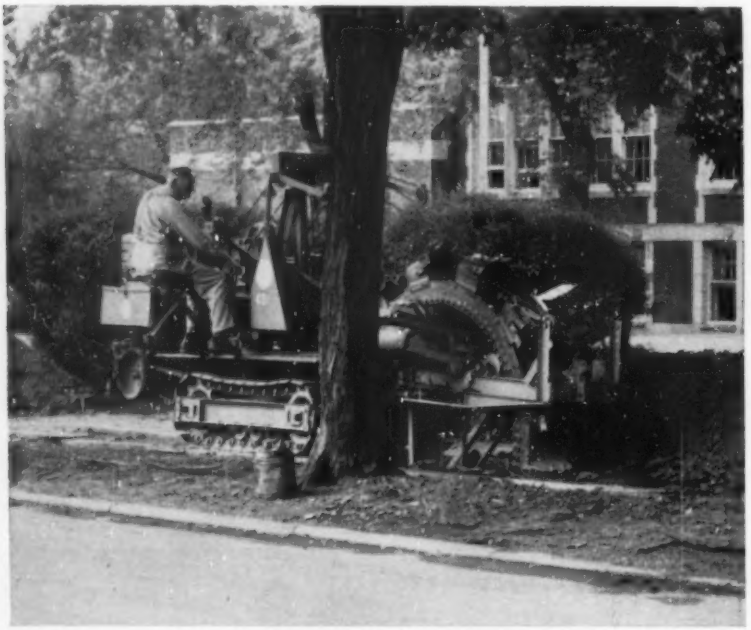
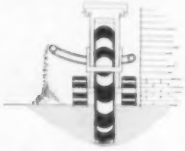
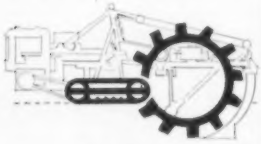


Nothing digs trench in the city like a Cleveland "Baby Digger"

PUTS TRENCH WITHIN
20 INCHES
OF A PARALLEL WALL



MORE THAN 30 USABLE
COMBINATIONS OF
CRAWLER AND
DIGGING WHEEL SPEEDS



GIVES YOU THE
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of POWER and SPEED
FOR EVERY SOIL
AND JOB CONDITION

If your jobs involve city and suburban trenching, a trim maneuverable Cleveland 92 is the trencher for you. This "Baby Digger" has the practical features and advantages that give you greater, more economical production in crowded areas *...more trench...in more places...at less cost.*

- Only 4' 6" wide over its crawlers.
- Shiftable, reversible conveyor.
- Digs easily past trees, poles, fences, etc.
- Digs 10" to 20" wide...down to full 5' deep.
- Full crawler mounting...completely maneuverable...perfect balance and stability...easy on lawns, sidewalks, etc.
- Finest crawler on any trencher...long-lived ...non-packing...easy-rolling...friction-free...sealed bearings...200-hour lubrication.
- Easily portable...hustles from job to job at safe, legal-limit truck speeds.
- Used on thousands of miles of trenching for gas...water...sewer...telephone...electric power...building footings...airport, highway construction.

fast • accurate • clean • dependable
nothing digs trench like a Cleveland

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20100 ST. CLAIR AVE. • CLEVELAND 17, OHIO

Good Everywhere ®

ing voices by contractors nor engineers, disputing the statement that forming the joint with a saw is a tremendous improvement over the old hand-finishing methods."

Naturally, like any other method of road construction, joint sawing must be done properly and at the right time. There are, however, today many miles of concrete pavement with successfully sawed joints. For example: At the Olmstead Air Force Base at Harrisburg, Pennsylvania, close to 200,000 cu. yds. of concrete were laid down last summer and sawed without any random cracks.

Vertical grooves in the slab every 12 feet, as recommended by Mr. Clemmer, are bound to result in the old "thump . . . thump . . . thump," when riding on the highway. It was our hope that this objectionable feature had forever been eliminated by sawing.

Proper load transfer from slab to slab is a necessity regardless of the method used to provide contraction joints, but only concrete sawing can provide these benefits:

1) Smooth riding quality due to the narrow width of joint;
2) Economy of installation and sealing;
3) Maximum aggregate interlock; and
4) No disturbance of concrete consistency with resultant spalling, such as occurs in hand forming or strip insertion.

Robert Janowitz,
Manager, Engineering Department,
Clipper Manufacturing Company

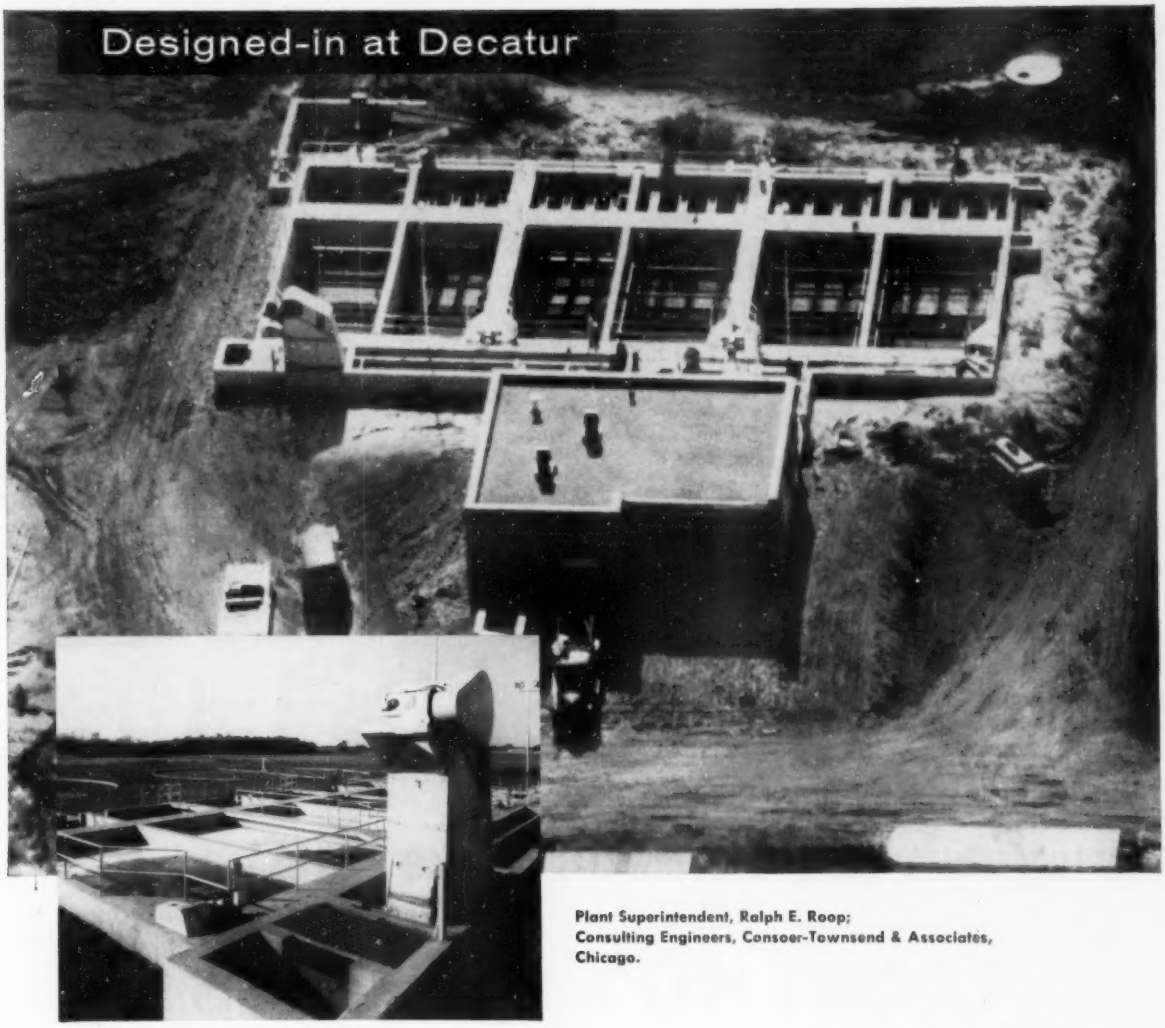
STRENGTH CLASSIFICATIONS FOR SEWER PIPE

In his article in Public Works, Nov., 1958. "Strength Classifications For Asbestos-Cement Gravity Sewer Pipe", Mr. Altemus makes two statements, which, I believe, are contrary to good engineering practice. These statements are:

"We have assumed in these calculations that the use of a safety factor of one is adequate, based on our experiences and knowledge of asbestos-cement sewer pipe."

"The new classifications will be utilized to the maximum if the various bedding methods required can be obtained simply and economically by the contractor. This, in turn, will permit the design engineer to reduce the provision for safety factors to compensate for problems of construction."

Neither the bedding methods and their corresponding load factors as



Plant Superintendent, Ralph E. Roop;
Consulting Engineers, Consoer-Townsend & Associates, Chicago.

Maximum efficiency in minimum space

The new Decatur, Indiana, trickling filter sewage treatment plant clearly illustrates how careful planning can produce a plant that is a model of compactness, neat arrangement and efficient operation. Rectangular channels and tanks were arranged so as to permit maximum use of common walls for compactness and greatest construction economies.

As the illustrations show, grit channels...primary tanks...final tanks...reaeration tanks...and chlorination tank are all neatly grouped, with common walls providing maximum efficiency in minimum space. The tanks are so arranged that expansion of facilities can be easily accomplished.

To translate compactness into efficient performance, CHAIN Belt modern waste treatment equipment was selected for both primary and final treatment stages. A Rex Chain and Bucket Type Grit Collector, installed in a 2′6″ wide x 42′6″ long x 4′ deep channel, provides effective removal of inorganic solids. A channel for future expansion was also constructed (see inset).

Rex Type ME Conveyor Sludge Collectors are installed in both the primary and secondary settling basins. Lever-operated Rex Roto-Skim skimming pipes are used to remove accumulated surface scum in the primary tanks. Common walls divide the three primary tanks, which are 16′6″ wide x 50′ long x 8′ average water depth, and the three final tanks, which are 14′6″ wide x 50′ long x 7′6″ average water depth.

For most efficient operation...for most effective results, why not put the CHAIN Belt team to work for you. For information on the complete Rex line, write CHAIN Belt Company, 4722 W. Greenfield Ave., Milwaukee 1, Wis.

REX®
CHAIN BELT COMPANY

Exclusive Austin-Western all-wheel steering permits operator to move a full load on the blade by steering rear end to offset sidethrust.

Carlisle, Pa., street superintendent says:

Versatile Austin-Western graders built for rugged year-round duty, low maintenance

"You don't have to baby an Austin-Western. It's one grader that's really built for rugged duty and low maintenance," says Morris R. Hill, Borough of Carlisle, Pa., street superintendent.

Highly maneuverable

He tells us "All-wheel steering makes it highly maneuverable in the narrowest alleys and streets. Handy sideshift action of blade lets you work close to any obstacle. The rear end steers to offset the machine and compensate for sidethrust from a fully loaded blade to move bigger loads farther and faster.

"All-wheel drive puts the front end to work and makes sure you've plenty of power and traction when you need it. It's a flexible grader. We use it all year round for grading, resurfacing, scarifying, and snow removal. We're very well pleased with the low maintenance costs on the A-W.

Easy to operate

"We've got a top-notch operator. With hydraulic controls he can do difficult precision jobs faster than possible with other graders. He says he wouldn't want to work any other grader—unless it was another Austin-Western!"

Austin-Western power graders are available in 4 and 6-wheel models. Choice of gas or diesel power. Torque converter optional.

Learn why so many municipalities acclaim Austin-Western versatility, hard-working efficiency, and operating economy. See your nearby A-W distributor now or write us.

Austin 100th YEAR Western
CONSTRUCTION EQUIPMENT DIVISION, AURORA, ILL.
BALDWIN · LIMA · HAMILTON
Power graders • Motor sweepers • Road rollers • Hydraulic crane

promulgated by Marston and his associates at Iowa State University or those outlined in my paper "Conduit Strengths and Trenching Requirements" which Mr. Altemus refers to, include any allowances for safety factor. Likewise the minimum 3-edge bearing strengths as given in the standard ASTM specifications do not include any safety factor. It is true that most samples of pipe tested under the ASTM specifications will show strengths considerably above the specified minimums and that the average strengths of the samples tested may be as much as 50 percent above the minimums. The fact that the average of a sampling will have strengths above the minimum, does not justify a conclusion that there is some factor of safety. From an engineering standpoint, we are interested solely in those samples that barely meet the minimum requirements, and on the results of such minimums, the design must be based.

When pipe is furnished under standard ASTM specifications, the user has no assurance that pipe strengths greater than the specified minimums will be furnished. His design, therefore, must be based on those minimum strengths outlined in the specifications which govern the furnishing of the pipe.

No engineering material, to my knowledge, is applied without using some factor of safety. A minimum safety factor of 1.5, I believe, has become generally accepted by the engineering profession for the design of rigid pipe conduits. I would suggest, to the readers of your magazine, that a safety factor of at least this amount be used in determining the design supporting strength of asbestos-cement sewer pipe.

H. H. Benjes,
Black & Veatch,
Kansas City, Mo.

• • •

County Engineers Will Meet in Minneapolis

The Seventh Annual National Highway Conference for County Engineers and Officials has been scheduled at the Leamington Hotel, Minneapolis, Minn., October 12-14.

Hosts for the 1959 Conference will include the Minnesota County Engineers Association, the Minnesota County Commissioners Association, the Minnesota State Highway Department and members of the highway industry. L. P. Pederson, Hennepin County Engineer, Minneapolis, is general chairman.

60,000 cars per day moved thru Dallas intersection

by

ELECTRO-MATIC®

TRAFFIC CONTROLS

Traffic conditions at the intersection of Northwest Highway and Preston Road in Dallas, Texas indicated the necessity of volume-density signal control. An average daily volume of 60,000 cars, sharp peaks, heavy left turns and intermittent pedestrian requirements all contributed to intensify the problem.

To insure a successful solution, the City of Dallas installed an Electro-Matic Model 1033 Volume-Density Controller. Now traffic moves through this intersection freely, and without unnecessary delays.

For literature describing this equipment write for Bulletin C-135D.

AUTOMATIC SIGNAL DIVISION

EASTERN INDUSTRIES, INC. • NORWALK • CONNECTICUT

safety everyone can afford

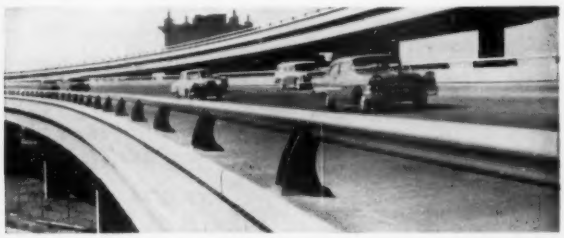
New Alcoa Aluminum Beam Guard Rail

Alcoa's new aluminum beam guard rail for highways combines maximum safety with modern appearance and minimum upkeep. Fabrication from high-strength aluminum alloys assures increased energy absorptive capacity.

Alclad aluminum provides permanent resistance to corrosion and means direct savings in maintenance costs. It resists the corrosive effects of road salts, industrial fumes and airborne grit. No painting—on or after installation—is necessary. Initial cost, only slightly higher than ordinary guard rail, is rapidly equalized by the savings in painting and other maintenance. Alcoa® Beam Guard Rail is available with aluminum posts, too.

Now is the time to get the full story on Alcoa Beam Guard Rail, Lighting Standards, Highway Signs, Overhead Structures and Chain Link Fencing. To learn how they help stretch taxpayers' highway dollars, call your nearest Alcoa sales office or write: Aluminum Company of America, 1912-D Alcoa Building, Pittsburgh 19, Pennsylvania.

BRIDGE RAILINGS of Alcoa Aluminum deliver maximum return for tax dollars, because first cost is last cost. Lightweight aluminum is easier to handle and faster to erect. Corrosion-resistant Alcoa alloys never need maintenance; they end painting costs that commonly run to a dollar per lineal foot per year.



OVERHEAD SIGN STRUCTURES eliminate periodic maintenance and the accompanying traffic tie-ups when they're built of Alcoa Aluminum. Tubular truss designs and single-chord spans meet any requirement and their lightness permits faster erection with minimum man power and equipment.

ALCOA ALUMINUM
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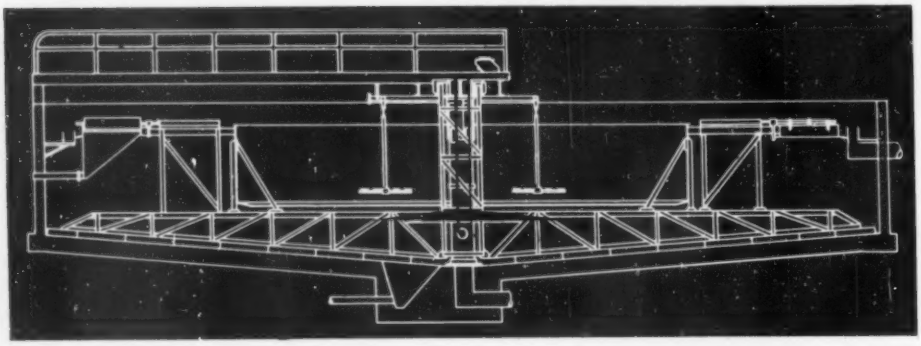
Your Guide to the Best in Aluminum Value

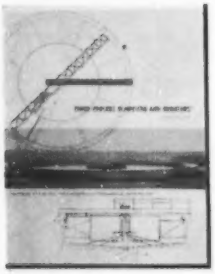
For Exciting Drama Watch **"Alcoa Theatre,"** Alternate Mondays, **NBC-TV** and **"Alcoa Presents,"** Every Tuesday, **ABC-TV**

Another Eimco-Process design innovation . . .



Internal sludge recirculators, Non-Clog Diffusers and a sludge thickening deflector are exclusive features of the Type CA Oxidator.

EIMCO-PROCESS OXIDATOR®—WITH CONTROLLED INTERNAL SLUDGE RECIRCULATION—INCREASES SOLIDS AND BOD REMOVALS



The complete line of Eimco-Process Oxidators, Clarifiers and other sedimentation equipment is described in our new Bulletin SM-1005. We will be happy to send you a copy on request.

Developed and introduced by Eimco-Process, and with a number of exclusive features, the Oxidator combines aeration, flocculation and sedimentation in a single circular tank. When aeration and flocculation of the solids are provided prior to clarification, many finely divided and colloidal solids that could not be removed by conventional sedimentation are flocculated and collected with the sludge. The aeration keeps the influent fresh and, combined with controlled internal sludge recirculation, gives increased floccule size, minimizes scum formation, and gives increased suspended solids and BOD removals.

In this unique design, internal sludge recirculation is accomplished through airlifts with intakes below the special sludge pocket protection deflector. By placing the intakes in this protected heavy sludge zone and controlling each lift with a separate valve, optimum recirculation rates can be obtained.

Gentle or intense aeration, adjustable sludge recirculation rates and controlled sludge thickening make the Oxidator the most flexible of all sedimentation equipment. Used alone, it can provide economical intermediate treatment; used with secondary equipment, it can substantially reduce total plant investment.

THE EIMCO CORPORATION
Salt Lake City, Utah

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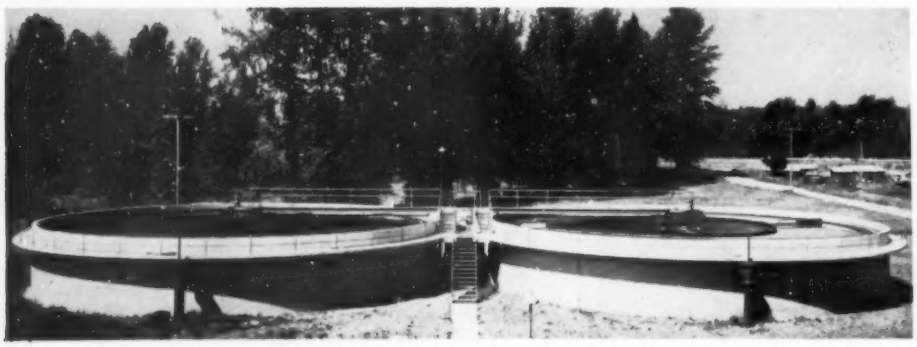
PROCESS ENGINEERS, INC. *division*
420 Peninsular Avenue
San Mateo, Calif.

. . another outstanding installation



Two 75 ft. dia. Type CA Oxidators, Puyallup, Washington. Consulting Engineers—Gray and Osborne, Yakima, Wash.

now! MUELLER®
copper meter yokes

...with a new "O" ring seal angle meter stop!

This exclusive new angle meter stop — now used on all Mueller Copper Meter Yokes — has a positive "O" ring seal at the top of the key. This "O" ring, plus the generous ground key surface between the port and top of the body, gives a dependable *double* seal against leakage.

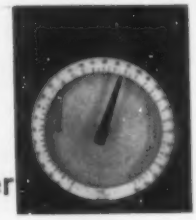
Before your next water meter installation, consider the many features of Mueller Copper Meter Yokes. They are typical of the attention to detail in research, design and engineering that becomes a part of every Mueller product made for the water industry.

Write direct for details on the full line of Mueller meter setting equipment.

MUELLER CO. **DECATUR, ILL.**

Factories at: Decatur, Chattanooga, Los Angeles;
In Canada: Mueller, Limited, Sarnia, Ontario

New Item . . .
RTM ROTO-TROL
Multi-Circuit Pump Controller



- *Recording and Indication when Desired*
- *Suppressed Head Type*
- *Any Distance between Transmitter & Receiver*

The RTM Roto-Trol operates on the time impulse principle. A tested and proved switching mechanism is operated by a powerful dual motor drive. The motor starters can be controlled direct from the heavy duty mercury switches.

Write for New Bulletin RTM

HEALY-RUFF Company
791 Hampden Ave., St. Paul 14, Minn.

FILTER SAND AND GRAVEL

A high grade of silica material hydraulically produced to meet specifications for effective size uniformity coefficient and exacting chemical requirements.

Prompt shipments from plants located in Roslyn, N. Y., and Port Jefferson, N. Y.

William J. McCormack Sand Division
Penn Industries, Inc.
136 East 57th St., New York 22, New York
MUrray Hill 8-9200

Municipal Power

Underground Construction Principles

BRUCE J. ENNIS
Principal Engineer,
Burns & McDonnell Engineering Company, Kansas City, Missouri

MOST ELECTRIC SYSTEMS utilize underground distribution to either a small or large extent, in order to transmit power generated in central stations to outlying substations and ultimate consumers. Even with systems relying on overhead pole line distribution, some underground ducts and cables are frequently necessary to carry the power from the plant to widely dispersed riser poles, where aerial distribution takes over without unnecessary congestion of poles and wires. Since underground construction is many times more expensive than overhead distribution, its use is generally reserved for power plant get-away, for distribution in built-up downtown areas when pole lines would not be feasible, at airports where overhead conductors would constitute a hazard to aircraft, in industrial plant yards where manufacturing activities preclude the use of pole lines, and in high class residential sections and shopping centers where overhead wires might be considered unsightly.

Underground construction consists of a system of wires and cables installed beneath the surface of the ground in one of the following manners:

1. Directly buried cable.
2. In earth encased conduit.
3. In concrete encased fiber or asbestos-cement duct banks.

Directly buried cable does not have the flexibility of cable systems installed in ducts or conduits. If additional capacity is required the installation cost of a second feeder is much like the cost of the original installation, since this system does not provide spare buried ducts or conduits into which an additional cable or larger capacity cable may be pulled at relatively small expense. However, for circuits in which there is no likelihood that a change in arrangement or capacity will be required for future expansion, a directly buried cable offers the lowest capital investment. Airport lighting, street lighting, and service entrance conductors are three examples in which consideration might be given to directly buried cables.

Neoprene jacketed rubber insulated cable is suited for direct earth burial. It should be buried fairly deep into the ground to exclude air in order to minimize attacks from soil micro-organisms. Neoprene and polyethylene jackets are highly resistant to this effect, and an armored covering over the synthetic jacket would, of course, provide additional mechanical protection. Nonarmored cables should be of shielded construction if connected directly to overhead lines in areas subject to severe thunder storms and lightning. Buried cable is subject to attack by rodents and termites.

Directly buried cables should be installed in a trench at least 18 inches deep to prevent damage by plowing, surface digging, or excavation for paving work. A sand cushion or other base material free from rocks is usually provided at the bottom of the trench, on which to lay the cable, which should then be covered to a depth of six to eight inches with similar material.

Parallel cables in the same trench are installed with a horizontal separation of at least six inches, without crossovers, and a creosoted plank or concrete slab should be installed on the sand or earth fill about six or eight inches above unarmored cables to protect the cable and to warn future excavation workmen of its presence. Cables are usually installed in conduits under highways and railroads. Trenches should be completely backfilled and thoroughly tamped up to the original ground surface.

Where it is desired to install a limited number of cable circuits and, at the same time, retain the flexibility and mechanical protection of an underground duct system, thick walled asbestos-cement or galvanized steel conduit may be buried in the earth to provide raceways for the cables. Steel conduit material is the most expensive; however, it offers the highest structural strength. It has the shortest life expectancy unless some treatment is added, such as a vinyl plastic coating now available, to prevent corrosion. Steel conduit is the easiest to install, can readily be bent to fit field conditions, and will not break due to loading or settlement

Actual photo of a #6 residual fuel of the type burned regularly by two *Enterprise* Engines at the Municipal Power Plant, New Smyrna Beach, Florida.

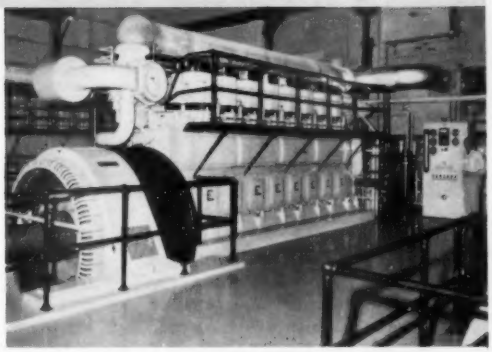
ENTERPRISE Does —and saves this city up to $4200 per month in fuel costs!

Here are facts of interest to any city that is thinking of using low cost residual fuels in engines for electric power generation.

Early in 1957, New Smyrna Beach, Florida put two DSR-38 *Enterprise* Diesels into operation generating 90% of its power load. They burn about 100,000 gallons of #6 residual fuel every month. *Both engines have now run on 80% average load continuously for over a year and a half without shutdown except for normal maintenance—with fuel savings as high as $4200 per month!*

This performance is typical of *Enterprise* Diesels. For they are designed and built to permit the widest possible latitude in fuel use. You can now order your new engine fully equipped for burning residual fuels. Or your present *Enterprise* Diesel can be converted to handle heavy fuel by installing the necessary oil heaters and centrifuges. No change in the basic fuel injection system is required if it's an *Enterprise*.

To be sure your diesel will handle low cost fuels and still turn in maximum performance—*without expensive maintenance and downtime*, specify Enterprise—custom crafted by the engine people that have the heavy fuel experience—and know how to use it!



These two 2500 HP *Enterprise* Model DSR-38 Turbocharged Diesels have turned in record performance on heavy fuel operation. Simple *Enterprise* open-type combustion chamber design makes handling of heavy fuels easy and economical.

ENTERPRISE
engine & machinery co.

DEPENDABLE ENGINES

Subsidiary of General Metals Corporation
18th and Florida Streets, San Francisco 10, California

Boston • Chicago • Jacksonville • Kansas City • Los Angeles
Minneapolis • New Orleans • New York • Pittsburgh
Seattle • St. Louis • Washington, D.C.

of the earth. Bare galvanized steel conduit should not be installed in areas where it might be subject to electrolytic corrosion.

Asbestos-cement conduit can be used quite successfully for applications requiring a single raceway in areas not subject to settlement or heavy surface traffic. It should be buried with at least 30 inches of earth cover. Newly developed polyvinyl chloride pipe conduit offers the flexibility of field bending as with steel conduit, with the imperviousness to corrosion that is available with asbestos-cement conduit.

For locations requiring the installation of several parallel circuits, a concrete encased duct bank provides a multiple raceway with complete flexibility and maximum protection for wires and cables. Spare ducts may be provided in the bank for future circuits, and existing cables may be replaced with larger cables for additional capacity.

The size of ducts will be determined largely by the size of cables to be installed; however, they should be of adequate size to contain the cables which might be installed in the duct bank many years in the future. In general, three-inch ducts cost 14 percent more than two-inch ducts, but contain 125 percent more area; four-inch ducts cost 20 percent more than three-inch ducts but contain 78 percent more area, and so on. As a general rule, four-inch ducts provide the most economical duct bank on the basis of the cost per square inch of duct area.

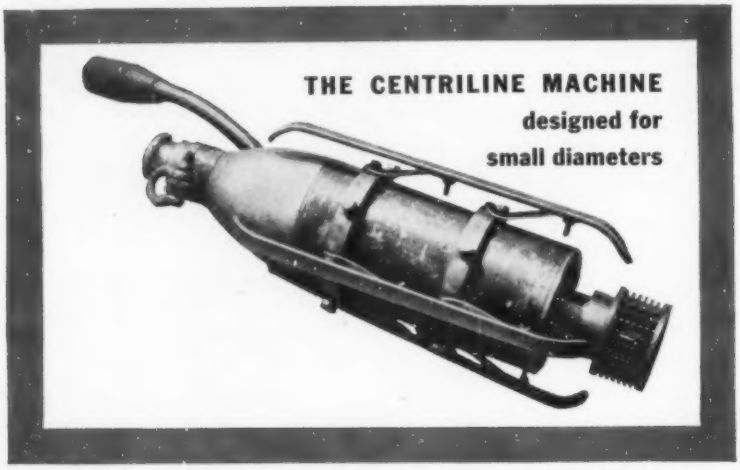
Duct separations should be two inches to permit adequate placement of concrete around and between the ducts, and coarse aggregate should not exceed ¾-inch in size, to prevent honeycombing. Cases have been recorded of a fault in one circuit in a duct bank carrying over to an adjacent circuit due to voids in the protective concrete between the two fiber ducts. The overall envelope around the periphery of the duct bank should be three inches thick. This is the minimum envelope thickness which will permit the installation of longitudinal reinforcing bars in duct sections requiring additional strength against differential settlement, such as through earth-fill areas, or under railroads and roadways.

For optimum heat dissipation, duct banks for power cables should be constructed two ducts wide, by the required number of pairs of ducts in depth. This also provides the best arrangement for training and racking large power cables in manholes. For control cables, where radiation of heat from interior ducts is not a problem, duct banks may be constructed three, four, or more ducts wide. Such an arrangement provides the maximum number of ducts in locations where the depth of the duct bank has to be kept to the minimum

Manholes should be rectangular in plan, if possible, to provide simple and inexpensive form work. For large diameter cables requiring long radius bends, it is frequently necessary to provide shaped manholes designed for the contour of the cables to be installed. Manholes are generally spaced along sections of duct lines as required for the desired pulling length of the cable to be installed. All duct banks should be graded and sloped to drain towards manholes, with no pockets for moisture to collect in the ducts themselves.

For a typical distribution circuit in areas where either underground or overhead distribution is acceptable, the cost of an underground duct and cable system may vary from five to fifteen times the cost of an equivalent overhead pole line circuit, more or less. In such cases,

NOW! THE CENTRILINE PROCESS is available for 6" to 14" mains, too!



Yes, your city's small but important transmission and distribution lines can also regain their original flow capacity and pressure through the universally accepted Centriline Process of centrifugally applying a cement-mortar coating to the pipe walls. If some of your lines inadequately serve your customers' requirements, including higher demands for fire protection, investigate the numerous advantages of Centrilining your mains now.

The new, small diameter Centriline Machine eliminates most excavations at valves, laterals and corporation cocks. By eliminating these fixed costs, lengthening the distances between access openings and permitting faster lining speeds, the new Centriline Machine has really reduced the cost of lining small mains. So much so, in fact, that every water works operator should reevaluate the economics of small pipe rehabilitation.

Send today for your copy of our illustrated booklet which fully describes how Centriline can help you salvage worn out pipes from 6" to 144" in diameter permanently and for much less than you would imagine.

CENTRILINE CORPORATION

A Subsidiary of Raymond Concrete Pile Company

140 Cedar Street
New York 6, N. Y.
WOrth 2-1429

Branch Offices in Principal Cities of the United States, Canada and Latin America.

"I bought another Sherman Digger because . . .

. . . competition is rough! To protect my business, I've got to have fast, maneuverable and trouble-free rigs that out-perform anyone else's. That's why I own two Sherman Power Diggers now and why, at one time or another, I have owned six Shermans. Performance is a must in my work—I get it with Sherman!"

CARL DIEM
Diem Septic Tank Installers, Flint, Mich.

Sherman units purchased from Otto P. Graff Tractor Sales, Flint, Michigan

Write for Bulletin No. 590

SHERMAN S PRODUCTS

POWER DIGGERS • LOADERS • SOIL WORKING TOOLS • FORK LIFTS
CRANES and EXCAVATORS • FOUR-WHEEL DRIVES

SHERMAN PRODUCTS, INC., Royal Oak, Michigan

the decision to use an underground cable circuit will depend on the relative merit of the increased reliability of the underground system, the freedom from overhead wires and attendant tree trimming, and related factors.

NEWS OF ENGINEERS

DR. WILLEM RUDOLFS, long time (26 years) head of the Department of Water Supply and Sanitation at Rutgers University, died Feb. 20, in Holland where he had lived following his retirement in 1952.

O. W. KAYSER and PETER H. SMITH have been made assistant vice-presidents of Gibbs & Hill, Inc., consulting engineers of New York.

JAMES W. CAWDREY of Seattle, Wash., is the new president of The Associated General Contractors of American. He is a member of the firm of Cawdrey & Vemo, building constructors. JOHN A. VOLPE of Malden, Mass., is vice-president. Chairmen of the three occupational divisions of AGC are: Building Contractors, ROBERT W. LONG; Highway Contractors, J. P. GIBBONS; Heavy Construction and Railroad Contractors, HOWARD H. STURDY.

STANLEY A. KROLL, formerly a vice president of Taller & Cooper, Inc., has opened a consulting engineering office at 315 Gold St., Brooklyn, N. Y. He will do all phases of electrical engineering including the design of special devices for revenue control.

MUNSON ASSOCIATES has been organized for consulting engineering work. Offices are at 19741 13 Mile Road, Roseville, Mich. Members of the firm are Albe E. Munson, John Grissim, William Bondarenko and Jack Anderson.

M. J. SHELTON, formerly Deputy Director of the California State Department of Water Resources, has joined the consulting engineering firm of Koebig & Koebig, Los Angeles. An office will be opened in San Diego (615 Broadway) which will be under charge of Mr. Shelton.

WALLACE J. BECKMAN and EDWARD T. DAVEL have become associates of Consoer, Townsend and Associates, consulting engineers of Chicago, Ill.

SHORT COURSES

Course on Shear Strength of Soils

A 2-week course on shear strength of soils will be held at MIT Aug. 31 to Sept. 11. Tuition $275. Information from Prof. J. M. Austin, Director of the Summer Session, Massachusetts Institute of Technology, Cambridge 39, Mass.

Biological Waste Treatment Short Course

Manhattan College will give a one-week course in the theory and design of biological waste treatment during the week of June 18. Emphasis will be placed on application of principles to various industrial wastes. Fee is $100. Write W. W. Eckenfelder, Jr., Civil Engineering Dep't., Manhattan College, New York 71, N. Y. for details.

Industrial Water Conservation

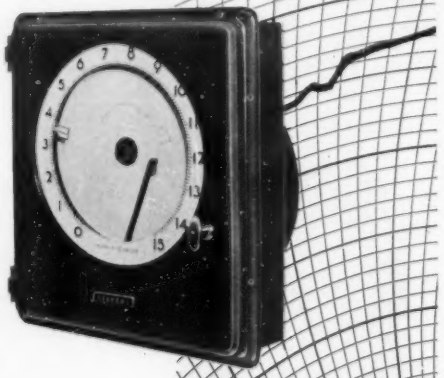
A short course of industrial water conservation will be held at the School of Public Health, University of Michigan, Ann Arbor, on June 8 and 9. More data can be obtained from H. E. Miller, Director, Continued Education.

ACCURATE GRAPHIC AND VISUAL REGISTRATION

of liquid flow with

STEVENS

RECORDER TYPE B-FT



Recording, indicating and totalizing meter for measuring sewage or other flows over Parshall flumes and weirs. This instrument has interchangeable flow cams and flow conversion gears... an important factor to consider for sewage treatment plants in rapidly growing communities. With a simple change of cams and gears the Type B-FT Recorder can operate with a different size flume or accommodate a greater range of flow than that for which it was originally purchased. The change does not require factory service. Similarly, change from weekly to daily time scale, or vice versa, is accomplished by merely repositioning one gear — no new parts to buy.

This recorder can be direct float operated or remotely controlled and is available for wall or switchboard mounting, or with cabinet for mounting out of doors directly over the float well. Request BULLETIN 25 for complete details.

STEVENS HYDROGRAPHIC DATA BOOK

Invaluable for your reference file. Contains technical data on recorder installations, plus a wealth of hydraulic and conversion tables. $1 copy. (No COD's)

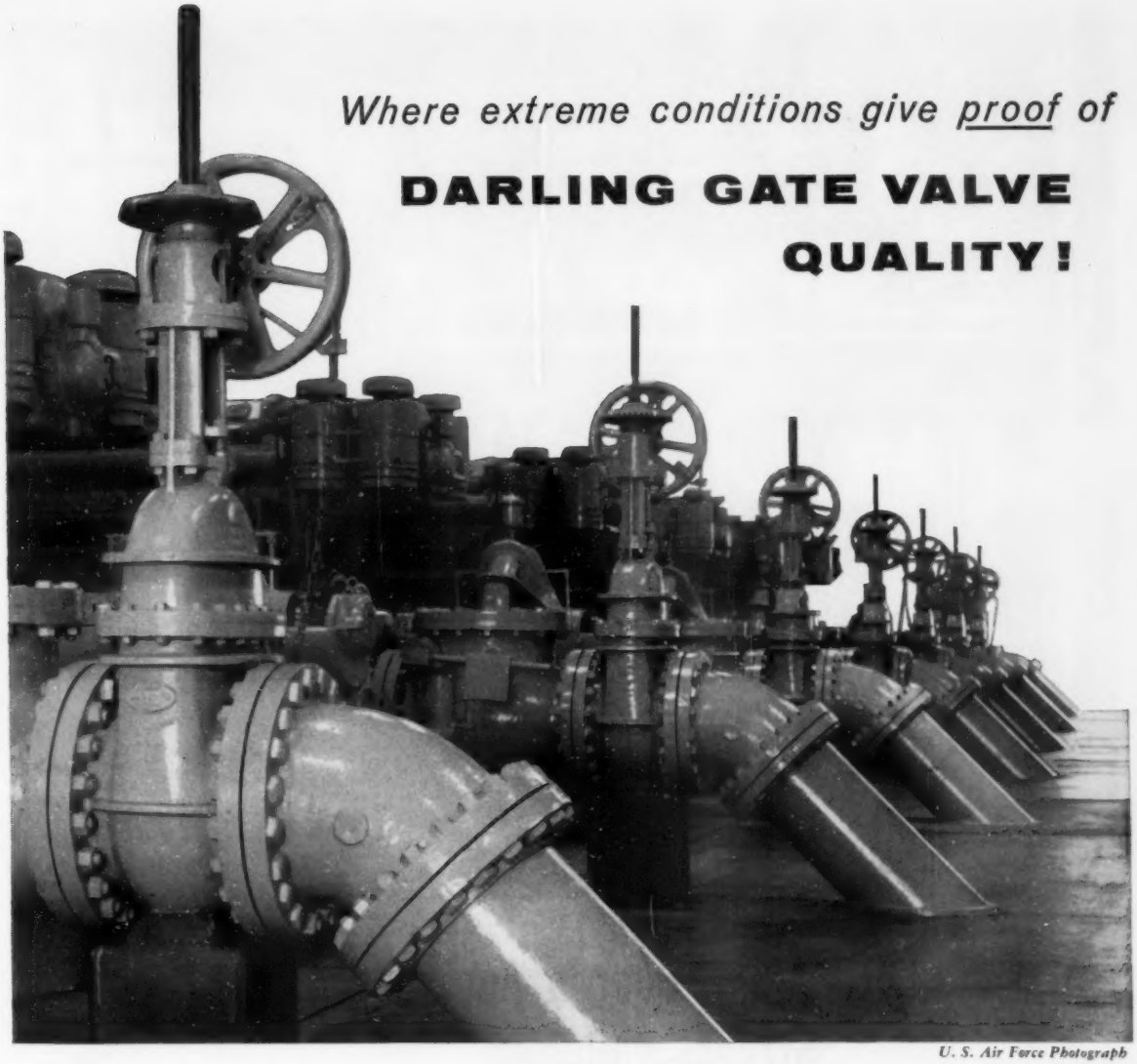
LEUPOLD & STEVENS INSTRUMENTS, INC.

4445 N. E. GLISAN STREET · PORTLAND 13, OREGON

Specialists in hydrologic instruments for over half a century.

Where extreme conditions give proof of

DARLING GATE VALVE QUALITY!

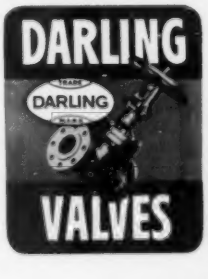


U. S. Air Force Photograph

From zero to 30,000 gpm demand...suddenly!

Fast pressure changes and heavy line surges are the rule in this system supplying water to the rocket launching pads at a large Air Force test center. The Darling valves installed here must take this severe service in stride . . . and still continue indefinitely to provide smooth, positive response!

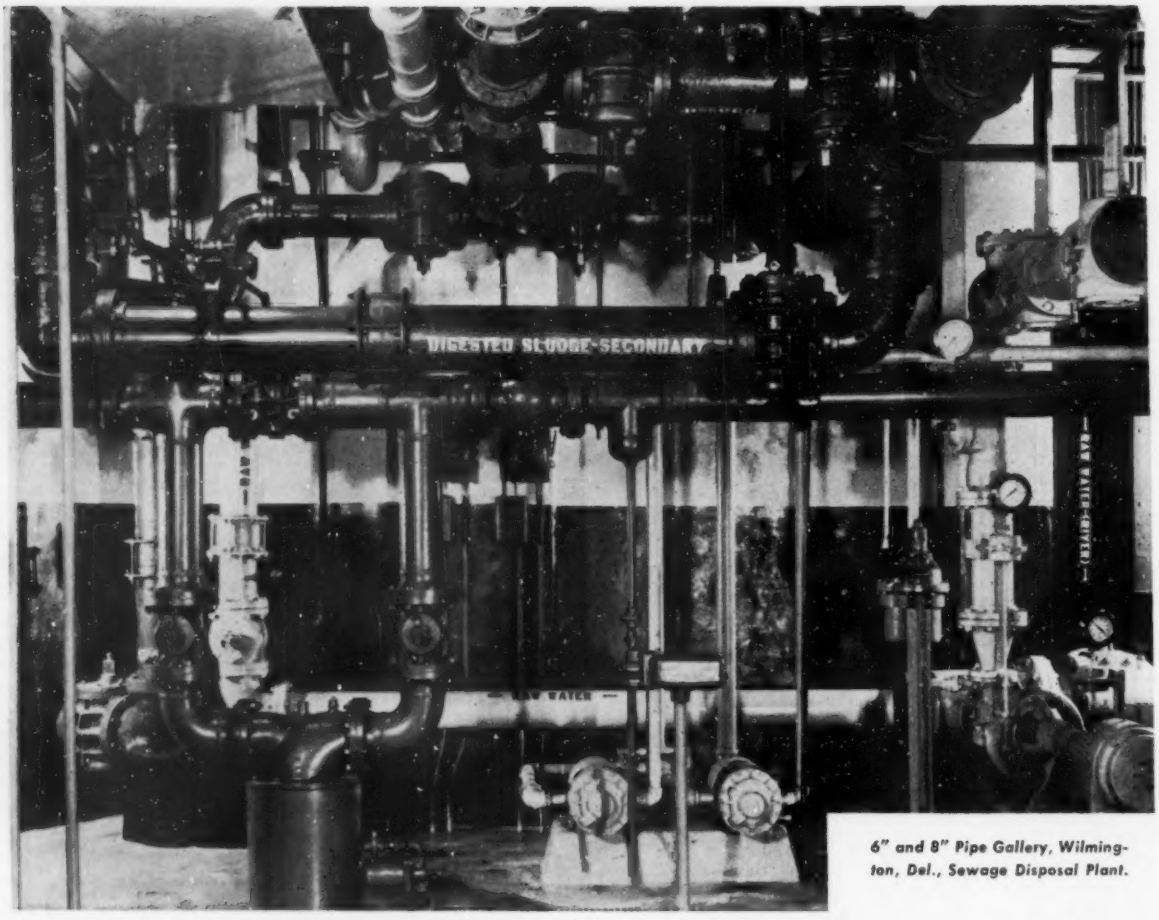
There are a number of Darling valve features that assure such performance—features that can help avoid trouble and maintenance in your service, too! For example there's the automatic seating compensation, uniform wear distribution and drop-tight closure assured by Darling's unique gate principle with its fully revolving double discs and parallel seats. You are certainly welcome to complete data on Darling gate valve features, sizes and types. Get *all* the facts! Send for Bulletin 5710.



DARLING VALVE & MANUFACTURING CO.

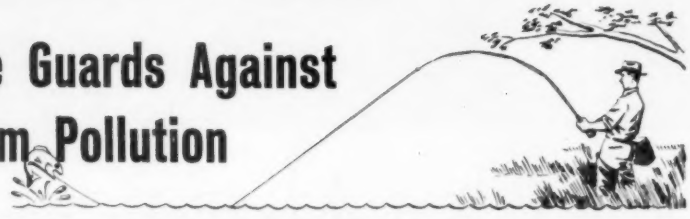
Williamsport 22, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford, Ontario



6" and 8" Pipe Gallery, Wilmington, Del., Sewage Disposal Plant.

Cast Iron Pipe Guards Against Stream Pollution



Every 12 hours a contract is let for a new sewage treatment works to clean up America's waterways and protect the public health.

Into these plants go thousands of tons of enduring cast iron pipe and fittings. Engineers designing these plants know that no other pipe material compares with cast iron in withstanding the corrosive effects of strong sewage, acids and treatment chemicals. And none has equal strength or a matching time-proved record of long life and low cost service.

Engineers also specify large cast iron pipe for sewer force mains to operate under pressure where strength, longevity and a minimum of jointings are a vital factor. So cast iron pipe not only serves to bring water to our cities and towns but takes it away for cleansing treatment and returns it pure for use again.

Our Company does not manufacture cast iron pipe but supplies many of the nation's leading foundries with quality pig iron from which quality pipe is made.

WOODWARD IRON COMPANY

Since 1882

WOODWARD, ALABAMA

GarWood

LOAD-PACKER® 600

NEWEST: THE ULTIMATE!

ONLY FROM GAR WOOD:

BIG SIX

PERFORMANCE

1. FASTEST OPERATION
2. GREATEST COMPACTION
3. BIGGEST LEGAL PAYLOADS
4. LARGEST, LOWEST HOPPER
5. SAFEST, MOST DEPENDABLE
6. GREATEST ECONOMY

NEWEST: THE LOAD

ONLY FROM GAR WOOD:

BIG SIX

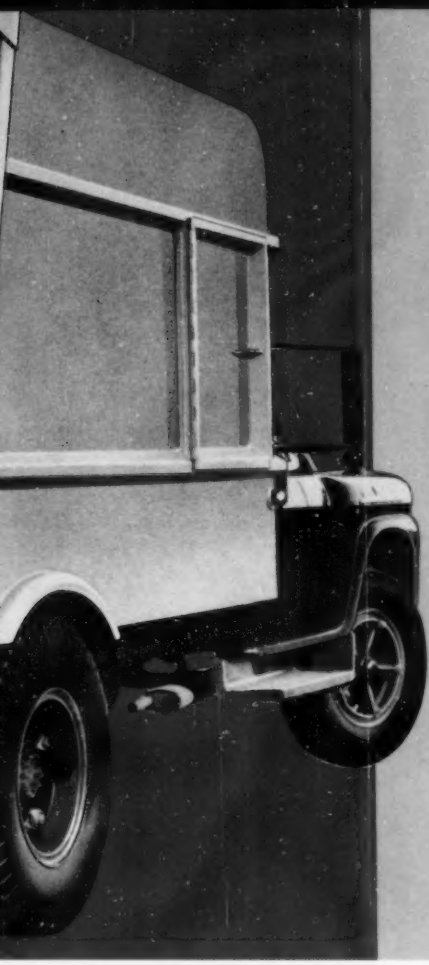
PERFORMANCE

1. FASTEST O

Crew starts reloadin
takes only 10 secon
the second most pop
as fast as the third.

3 BIGGEST LEGAL PAYLOAD

4 LARGEST, LOWEST, HORSES



BIG SIX

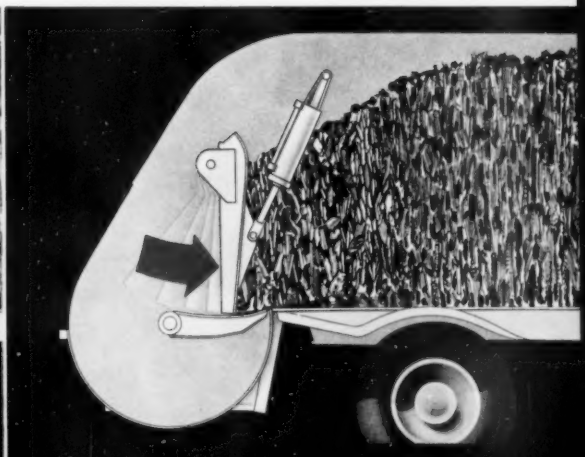
your new standard

Now, for the first time, one refuse collection Body that excels in all the prerequisites of performance. It is, of course, from Gar Wood, originators of modern, sanitary refuse collection. Its name, naturally, the LOAD-PACKER, the first, most famous name in packer bodies. Here's BIG SIX performance; the ultimate in refuse collection efficiency. Ask your Gar Wood Dealer about the LOAD-PACKER 600 . . . the refuse collection Body that's first in everything that counts . . . the only Packer that gives BIG SIX performance.

D PACKER 600

OPERATION

ading in just 4 seconds . . . full cycle econds. That's four times faster than popular packer . . . almost three times hird. Speed means better service .



2. GREATEST COMPACTION

Packs more than any competitive body by actual tests. Rotary panel sweeps refuse to floor level . . . packing panel makes powerful direct thrust against load. Piston rods are hardened, chrome plated.

3. BIGGEST LEGAL PAYLOAD

Biggest loads on any given chassis. Two reasons . . . First: Gar Wood engineers cut dead weight to a minimum. Second: exclusive new feature results in unexcelled weight distribution. Revolutionary chassis-mount telescopic hoist eliminates heavy, conventional hoist sub-frames. Dual purpose packing cylinders keep tailgate weight down. With the 600 you carry more, yet stay within road limits.

4. LARGEST, LOWEST HOPPER

Big 1½ yard, 74 inch wide hopper, plus low loading height speeds collection, makes crew's job easier. Three men work side-by-side . . . there's no overhead restrictions . . . crew handles biggest refuse easily. And the biggest hopper means fewer packing cycles.

5. SAFEST, MOST DEPENDABLE

Controls are simple, foolproof . . . operator has positive control . . . can stop mechanism instantly. And, the 600 is built to last . . . Engineered for less maintenance. There are fewer moving parts to go wrong. It's tops for crews and public works management alike.

6. GREATEST ECONOMY

Big hopper cuts down packing cycles . . . moreover, the 10 second packing speed means the engine runs at accelerated, solenoid speeds as much as 30% less than other packers. This, of course, means less fuel consumption . . . less wear and tear on packer, chassis and engine.

LOAD PACKER: THE ULTIMATE *plus*...

The BIG SIX is but a part of the 600 story. Here are still more of the many reasons why it's a must to get the complete facts from your Gar Wood distributor:

- Simplified Design . . . fewer moving parts, less linkage, fewer adjustments. All parts easily accessible.
- Non-Selective loading . . . no delays to crush big objects . . . assures complete service.
- Hydraulic system operates at lower pressures for less strain on hydraulic system.
- Exclusive dual volume pump reduces strain of drive line by 33%.
- A body size for every operation . . .*10, 13, 16, 18 and 20 yard capacities.
- Unmatched distributor service . . . the world's top truck equipment specialists sell and service your Load-Packers. Prompt parts delivery . . . factory trained service personnel.

HYDRAULIC CONTAINER EMPTIED IN 15 SECONDS

Yes, your containers will operate with the 600's exclusive hydraulic Load-Lift. And Gar Wood's popular Roll-away, Pax-all containers can cut costs and improve sanitation on your commercial route. For the complete Gar Wood container story, see Bulletin W-211A.

GREATER STABILITY . . . LESS WEIGHT

Gar Wood, inventors of the telescopic hoist, now offer a dumping mechanism that combines fast, positive cleanout and maximum stability, with less weight and better weight distribution. Ball and socket mounting ends side load stresses. This advanced, job proved hoist from the world's leader in dump truck equipment can be counted on for long, trouble-free operation.

LOAD-PACKER® 600

a product of GarWood

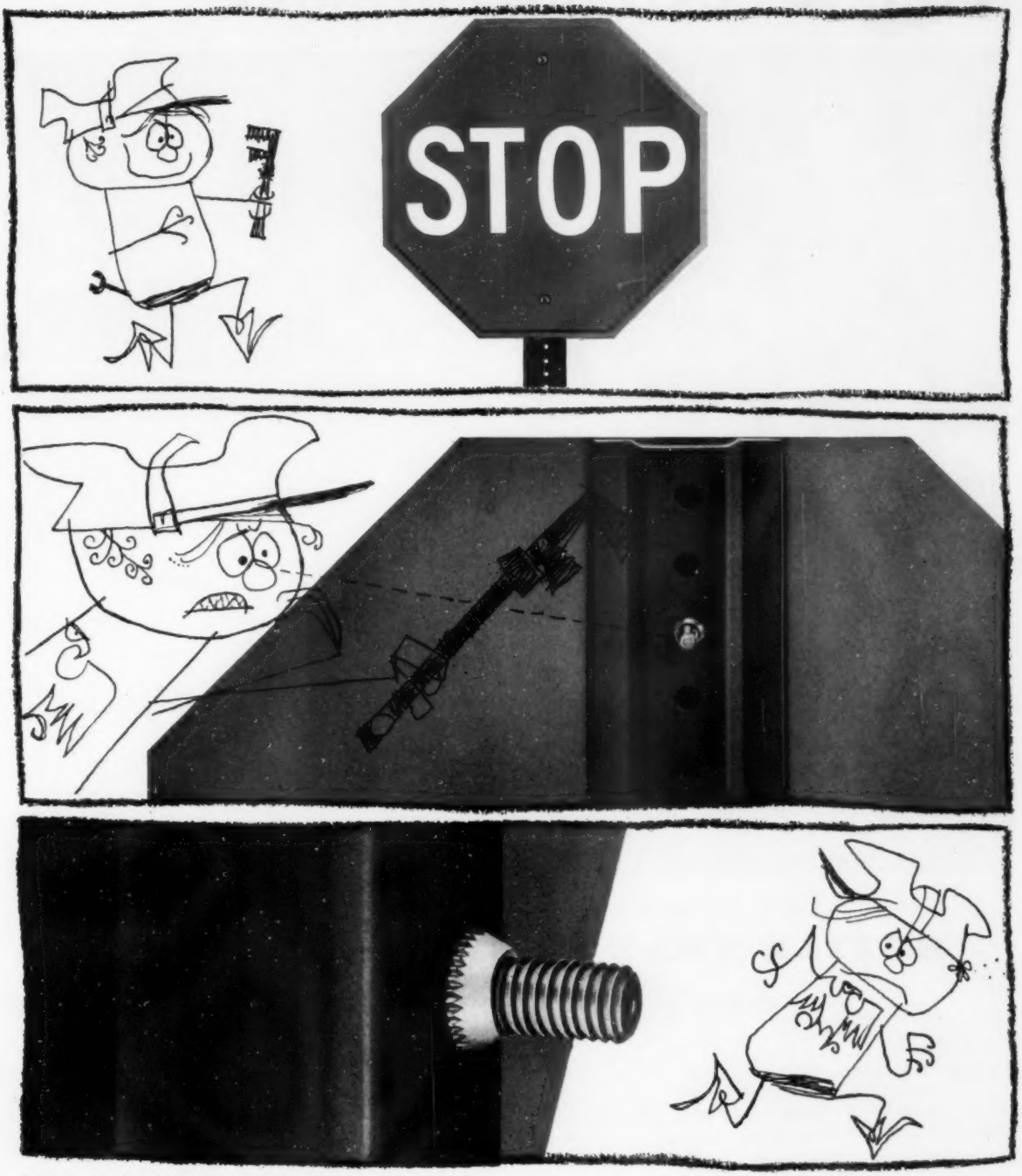
Richmond, California Wayne, Michigan

Form W-221-3-58 Litho in U.S.A.

*10 yd. model—1 yd., 58 in. wide hopper.

BIG SIX STORY

Get the complete 600 story . . . ask your Gar Wood distributor to see the colorful, sound film presentation, "The BIG-6 Story."



Eliminate sign theft for pennies more . . .

NEW ALCOA TAMPER-RESISTANT FASTENERS!

For facts, contact your nearest Alcoa sales office, or your local Alcoa® Aluminum sign blank jobber now. Aluminum Company of America, 1709-D Alcoa Bldg., Pittsburgh 19, Pa.

ALCOA ALUMINUM

For Exciting Drama Watch "Alcoa Theatre," Alternate Mondays, NBC-TV, and "Alcoa Presents," Every Tuesday, ABC-TV
Your Guide to the Best in Aluminum Value

DOW | **CALCIUM CHLORIDE**

SETTLE THAT DUST . . . cut road maintenance, too, with Dow calcium chloride

Farmers, housewives, motorists—in fact, anyone living on or near unpaved roads continually fights a dust problem. That is, unless the roads are being treated with Dow calcium chloride to keep dust in its place.

By attracting more than its own weight in moisture, Dow calcium chloride dampens the roadbed, settles dust. Both Dowflake®, the 77-80% flake type, and Peladow®, the 94-97% concentrated pellet type, are easy and economical to spread . . . can be applied dry or in a water solution. One application compacts road surfaces for many weeks.

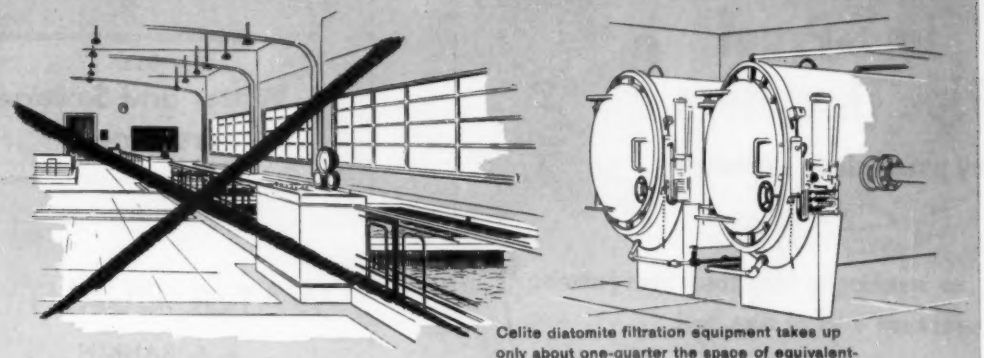
Dowflake and Peladow save in road maintenance too! Engineers estimate that untreated roads lose about 200 cubic yards of aggregate per mile in a year; while calcium chloride treated roads show an average loss of *only 25 cubic yards!* Thus the binding effect of Dow calcium chloride reduces gravel loss and blading costs by *as much as 80%!*

Settle dust problems the easy, economical way by using Dow calcium chloride! Dow's Highway and Construction Materials Engineers will be glad to help you with information or engineering counsel.

For local assistance | Write THE DOW CHEMICAL COMPANY, CC400EC4, Midland, Michigan.

THE DOW CHEMICAL COMPANY, MIDLAND, MICHIGAN

1. REDUCE FILTER HOUSING SPACE 75%



Celite diatomite filtration equipment takes up only about one-quarter the space of equivalent-capacity sand filter systems.

2. USE LOWER-COST CONSTRUCTION

Smaller floor space needed for diatomite filtration permits lighter, lower-cost building methods and materials.

You save filtration construction dollars these 2 ways with Celite diatomite

One installation after another proves you need about 75% less filter housing space for equivalent capacity when you use diatomite filtration with Johns-Manville Celite*.

Also, diatomite's lighter, smaller equipment permits you to use lower cost building methods and materials. For example, a simple concrete slab with light framing and siding instead of a large reinforced concrete-and-brick building with built-in concrete filters#.

Diatomite filter equipment is so compact because it provides a much larger filter surface in proportion to size of equipment. In many cases, raw water can be filtered directly—pre-treatment facilities can be eliminated. For Celite removes more suspended solids, including amoebae and algae, and turbidity is usually much lower.

Mined by Johns-Manville from the world's largest and purest commercial diatomite deposit, Celite is carefully processed for purity and uniformity. It is available in a wide range of grades for best practical balance of clarity and flow rate with any suitable filter. For further information, see your nearby Celite engineer. For free technical reprints and illustrated brochure, write to Johns-Manville, Box 14, N.Y. 16, N.Y. In Canada, Port Credit, Ont.

*Celite is Johns-Manville's registered trade mark for its diatomaceous silica products.

#*See Comparison Studies of Diatomite and Sand Filtration* by G. R. Bell, Journal American Water Works Association, September, 1956 or write for free reprint.

JOHNS-MANVILLE

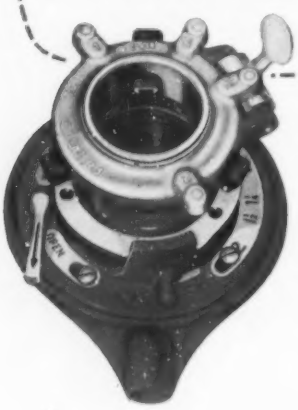
With these 3 RIDGID®

Jam-Proof Pipe Threaders

my power drive threading is Safe...

...no watching to keep them from jamming

...save me a lot of time, too!



1" to 2" Pipe
RIDGID
65R-TC

Jam-proof—can't jam if you forget it . . . Threads 4 sizes of pipe and conduit with 1 set of dies . . . True-Centering workholder—no more crooked threads—but adjustable for drip threads. Far more for your money—compare!

2½" to 4" Pipe
RIDGID 4PJ

Jam-proof . . . drive pinion kicks out automatically—real safety when power threading. Workholder sets to size before putting on pipe. Other exclusive advantages. Special 4PJ for conduit.

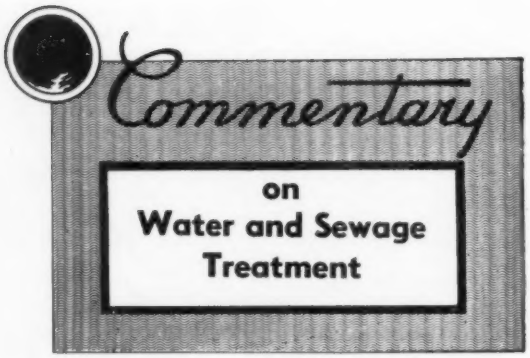
4" to 6" Pipe . . . RIDGID 161

Jam-proof for safe power threading. 1 set of dies threads 4", 4½", 5" and 6" pipe and conduit—sets to size fast. Workholder sets to size before putting on pipe, a work-saver feature. Many other reasons why the 161 is your best buy!

See and try these popular RIDGID Threaders . . . at your Supply House.

The Ridge Tool Company Elyria, Ohio, U.S.A.

THREADED PIPE . . . It's Tight . . . It's Best . . . Costs Less!



WATER QUALITY

R. S. RANKIN

Consultant, Water and Sewage Treatment

IMPROVEMENT IN water quality should be the continuing objective of every progressive purveyor of water until he can boast that "every drop is pure and palatable." This objective is attainable in practically every water works system today with the application of demonstrated methods. The purveyor, whether public or private, who cannot make this boast is too often content to do nothing until forced by an aroused public opinion. Often he has no urge even then; and knowing he has no competition he is content to drift on year after year and do nothing. His product meets the U.S. Public Health standards so why bother to improve it! The answer is that, until he can meet the test of this slogan, he is furnishing his customers an inferior product.

The palatability of water delivered to consumers, while not a new subject, is one which is still being neglected in many areas having untreated surface supplies. According to a survey in 1955 by the USPHS, 37% of the population of communities over 25,000 are supplied with water which has received no treatment other than disinfection. Some of this group are supplied with ground water but the majority is supplied with surface water. In addition, there must be an equal percentage of the population in communities under 25,000 using unfiltered surface supplies. This means then that a large segment of the population is supplied with water which is probably safe hygienically but on which little or no effort is being spent to remove the odor and taste producing constituents. Other important attributes, of course, can be mentioned to describe a water of quality such as softness, non-staining and non-corrosive, but taste, odor and clarity are characteristics which every consumer can determine for himself.

The often quoted USPHS standards deal extensively with bacterial standards of purity and probably most every one of the 18,000 water systems in the United States meets them. However, on color and turbidity they state "The turbidity of the water shall not exceed 10 ppm nor shall the color exceed 20 ppm." An operator of a filter plant would be horrified if his plant turned out a treated water no better than this standard permits. In fact if he has a turbidity of over 1.0 ppm he is probably worried. Most specifications, even for pretreatment units ahead of filtration, require an effluent turbidity of not over 10 ppm

As time goes by, Rust-Oleum long wear assures lower cost over-the-years protection!

Rust-Oleum is distinctive as your own fingerprint. Accept no substitute.

Rust-Oleum's *unusual* resistance to extremes in rust-producing conditions—from sun and salt water to humidity, moisture, fumes, and weathering—assures you of lasting beauty. Long wear made possible, because Rust-Oleum's *specially-processed fish oil vehicle* works down through the rust into the tiny, microscopic pores in bare metal to STOP RUST. Important savings are realized by applying Rust-Oleum 769 Damp-Proof Red Primer *over rusted metal* after scraping and wire-brushing to remove rust scale and loose rust—as costly surface preparations are usually eliminated. See how Rust-Oleum can save you money . . . in your plant, or your home. Prompt delivery from Industrial Distributor stocks. Write for illustrated literature with color charts.

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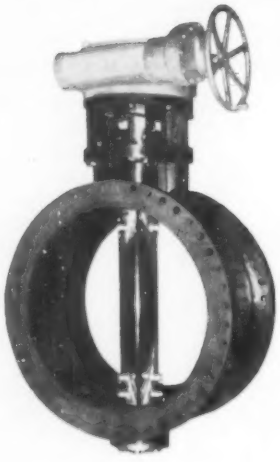
FABRI-VALVE

BUTTERFLY VALVES



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FABRI-VALVE offers many advantages in their butterfly design. Standard designs in sizes up to 24 inches, and custom engineering for applications up to 60 inches. By utilizing either cast or fabricated construction, your valve needs are fulfilled, giving the most efficient, dependable, and economical installation. For more information, call the distributor in your area or write

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and 5 ppm is not at all uncommon in actual practice. The effluent of a pretreatment unit thus theoretically complies with the foregoing standard but obviously no operator would think of turning it directly into the mains. In effect there is one standard for supplies which are not filtered, and another for those which are filtered. Either this is unfair financially to the group who have to pay for the operation of a filter plant or unfair to the other group who have to accept a water of inferior quality. Since no community which has used filtered water ever wants to save money by abandoning filtration, it follows that those not receiving filtered water are missing something. They do not receive a quality product.

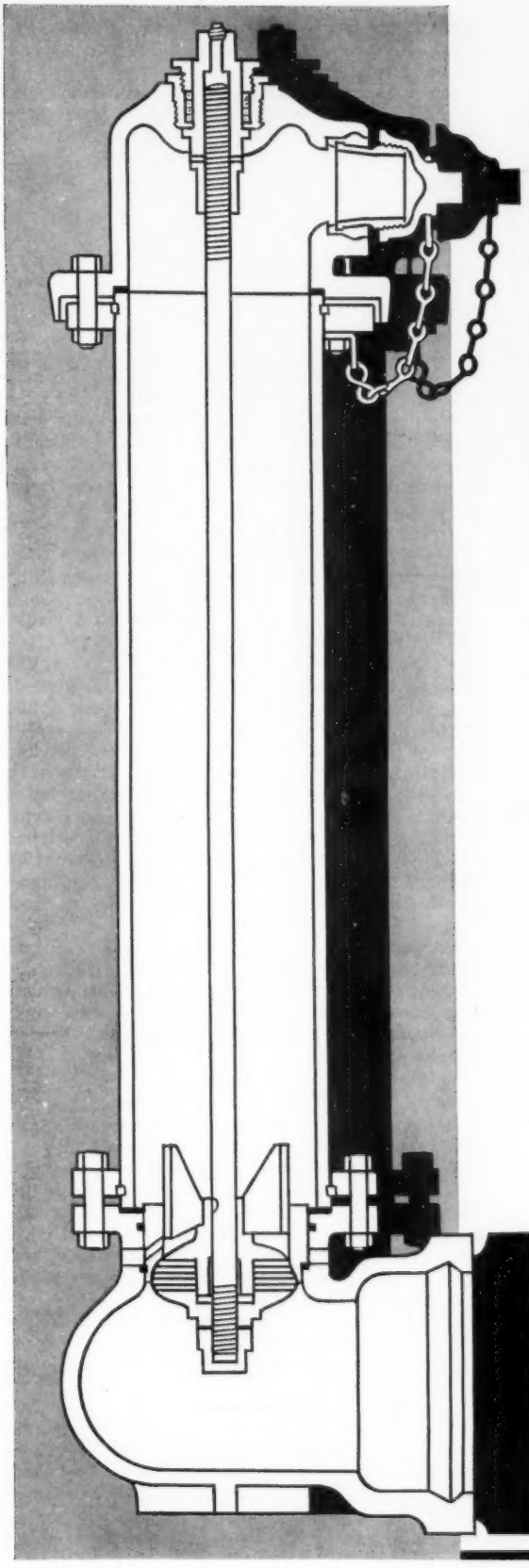
The same standards go on to state "The water shall have no objectionable taste or odor." The application of this standard will depend to a considerable extent on what a community becomes accustomed to. A few may complain about bad tastes and odors but public complacency often can be relied upon by the water utility to sit tight and do nothing about it. Yet there are many communities where the complaints of the few discerning ones are heeded by a progressive manager and remedial measures are taken.

The question of improving water quality in those areas supplied by surface sources in most cases is up to the utility, whether it is public or private. It becomes a question of initiative. Surface supplies, as a rule, tend to deteriorate as time goes on due to various causes. Drainage areas unavoidably become more thickly populated with consequent increase in potential pollution. Taste and odor producing agencies are perpetually active in reservoirs, and reservoir size alone is no cure; if it were cities on the great lakes would not need their filter plants. Neither does the answer lie in ever-increasing chlorine dosages and the intelligent water works man knows this. He knows that by means now available to him, he can deliver a water with no discernible taste or odor and with practically zero turbidity. And he can do it every day of the year.

The Need for Treatment

All this points to only one thing: The need for treatment works where these objectionable conditions prevail. Rules and regulations notwithstanding, the only sure way to overcome objectionable tastes and odors and disagreeable turbidity, and turn out water of high quality is by proper treatment. The consumer cannot well object to the increased cost, providing he is properly informed. As has been repeatedly pointed out by others, water has been too cheap; but it is also true that in many cases the public has been getting in quality only what it pays for.

One other aspect of present conditions which adds to the need for treatment of surface supplies is the potential hazard of radioactive fallout resulting from the products of nuclear fission. Surface supplies are particularly vulnerable to contamination from this source and the best protection is a treatment plant to remove this material or at least reduce it. The safe limit of exposure to radiation from the fallout of one of these products, strontium-90, has recently been recommended to be lowered to one-tenth of previous limits. It has been demonstrated that by using the cold lime-soda process in a water treatment plant, most of the strontium-90 can be precipitated. Most treatment plants with minor changes can operate using the lime-soda process. While the con-



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THE R. D. WOOD HYDRANT SUPPLIES MAXIMUM RELIABILITY AT MINIMUM COST

- Valve opens against water pressure—water pressure holds it closed in case of accident
- Every point of friction is protected by at least one bronze surface
- Head revolves 360°; simply loosen bolts and rotate
- Optional break-point flange with frangible coupling in hydrant stem makes it unnecessary to excavate in case of a broken hydrant
- Available for bell, flange and mechanical pipe connections; with conventional or "O" ring packings

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Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe
(centrifugally cast in sand molds)

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WATER TREATMENT
PROBLEMS
WITH
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FERRIC SULFATE

FERRI-FLOC produces rapid Floc Formation — Controls Taste and Odors — Coagulates Over Wide pH Range — Increases Filter Runs — Removes Turbidity, Color, Manganese, Silical and Bacteria . . . Ferri-Floc is a free flowing granular salt that can be fed through most standard dry feed equipment . . . Ferri-Floc is easy to handle and will keep for long periods of time in closed hoppers.

WATER TREATMENT
Efficient Coagulation of Surface or Well Water—Effective in lime soda-ash softening — Adaptable in treatment of all industrial applications.

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Coagulates over wide pH ranges and provides efficient operation regardless of rapid variations of raw sewage — Very effective for conditioning sludge prior to vacuum filtration or drying on beds.

COPPER SULFATE safely controls about 90% of microorganism normally encountered in water treatment plants efficiently and more economically than any other chemical.

SULFUR DIOXIDE is used most effectively for dechlorination in water treatment and to remove objectionable odors remaining after purification.

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Let us send you without charge, a 38-page booklet that deals specifically with all phases of coagulation—just send us a postal card.

TENNESSEE CORPORATION

sumer is not now worrying about this, the purveyor of water has a degree of responsibility which should not be shrugged off.

Coincident with the Water Works Advancement program of the American Water Works Association, it is suggested that every water works manager subject his system to a critical examination and ask himself whether a quality product is being delivered to his consumers. Of course, he can say it is safe but that is only a single measure of quality. Unless he can say as well that every drop is clear and palatable at all times, he is giving his customers an inferior product. Who is going to pay for this? The consumer, of course, and gladly if properly informed. If he now buys 500 glasses of inferior water for one penny, it is doubtful whether he will complain if he can buy only 300 or 400 glasses of quality water for that same penny. Where does the initiative lie? In most cases right on the doorstep of the water works manager. Other public utilities are constantly improving the quality of their product and getting paid for it. Why should the water utility be an exception?

• • •

South Carolina Road Work Program

A highway construction program costing more than $86 million has been recorded by the South Carolina State Highway Department for 1958, making it the "biggest and best" year in the history of the state. The estimated cost of construction projects let to contract, including engineering and rights-of-way, amounted to $86,400,000 in 1958, about double the total for the previous year. Contracts to be awarded during 1959 are expected to bring the total cost of the construction program in that year to around $82,500,000. Maintenance expenses, including expenditures for retreatment of worn pavements, reached about $12,600,000 in 1958, and there is expected to be a corresponding expenditure in 1959. Maintenance costs in 1959 may run slightly higher than in 1958 if there is extensive damage to roads from severe weather.

Interstate System projects placed under contract during 1958 totalled 144 miles, bringing to 218 miles the total of all interstate routes let to contract since July, 1956. South Carolina will ultimately have about 670 miles of the controlled-access Interstate System expressways.

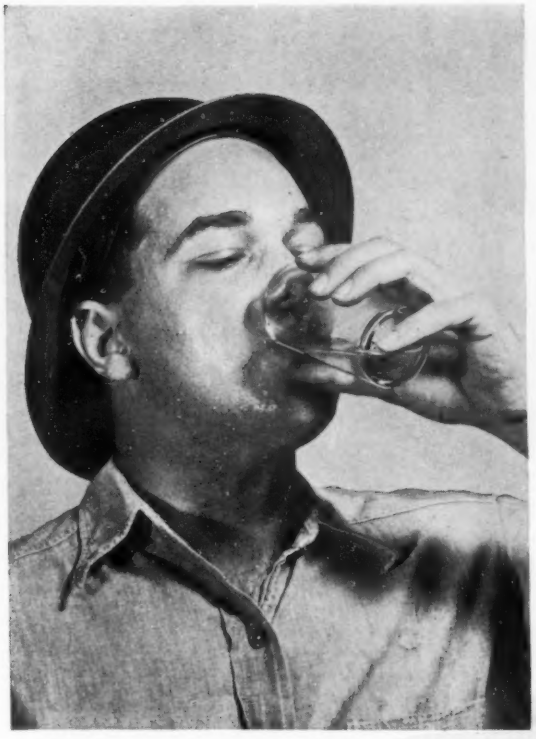
• • •

Fatalities on Toll Roads

The American Bridge, Tunnel and Turnpike Association reports that during 1958 the nation's toll roads continued their record of being safer for travel than other highways in the United States; 19 major toll roads achieved a combined record of only 2.8 fatalities per one hundred million miles of travel, while the rate on all other highways of the country was reported as 5.6 fatalities per 100,000,000 miles by the National Safety Council.

During the three reported years of 1956-57-58, the average fatality rate on the toll roads was 2.8 per hundred million miles and more than 5.9 for all other highways.

The most outstanding safety records during 1958 were registered by the 18-mile Denver-Boulder Turnpike with no fatalities; the 538-mile New York State Thruway with a rate of 0.9 fatalities per hundred million miles; New Jersey's 173-mile Garden State Parkway with a rate of 1.0; and the newly opened 129-mile Connecticut Turnpike with a rate of 1.5.



Water tastes best when it doesn't!

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ACTIVATED CARBON FOR TASTE AND ODOR CONTROL

When it comes to tastes in their water supply . . . even pleasant tastes . . . your community will thank you most for what you *don't* deliver.

One way to be sure your water is consistently palatable is to rely on daily threshold odor tests and AQUA NUCHAR activated carbon. By prompt detection and effective control, you stop tastes and odors before complaints start.

To assist you in setting up an economical and efficient PALATABILITY program in your plant, call on our experienced field technical service. At no obligation to you, we will be glad to survey your plant and recommend procedures tailored to fit your particular requirements.

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Long sections can be handled with light equipment.

Connecting half-bands are imbedded in asphalt.

Connecting half-bands are bolted, for a tight, leak-proof joint that won't pull apart.

Republic *FREE FLOW* Sewer Pipe speeds up sewer construction

Thousands of new sewers are needed throughout the country as the result of the building boom. In fact, some communities have ruled that sewers must be installed before any more building permits will be issued. The pictures on this page illustrate how Republic FREE FLOW Sewer Pipe can speed up sewer construction.

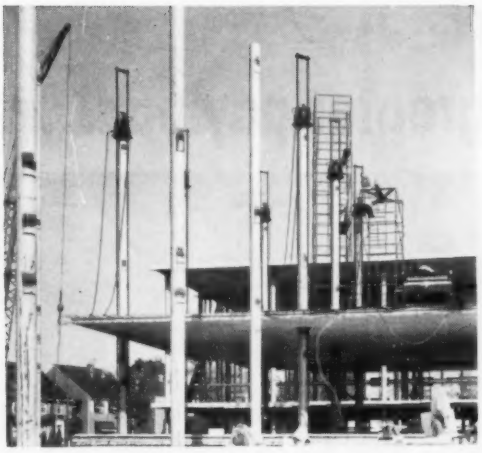
They show the 1410-ft. installation of 24″-diameter Republic FREE FLOW Pipe on Puritas Road, Cleveland, Ohio. This job was completed in *days* instead of months, because FREE FLOW is:

1. Lightweight . . . easy to transport, easy to handle.
2. Furnished in long sections . . . for easy installation.
3. Easy and quick to connect with leak-proof joints.

In addition a FREE FLOW installation gives you:

4. Flexible strength . . . ability to withstand flexure without damage . . . joints that won't pull apart.
5. No breakage during installation.
6. Non-spalling characteristics.
7. Superior erosion- and corrosion-resistance.
8. Free flow without turbulence.

Get a combination of all these superior features in Republic FREE FLOW, the corrugated, riveted, galvanized, coated metal pipe with the smooth, asphalt-lined interior surface. Mail the coupon for your copy of Republic FREE FLOW Sewer Pipe, ADV. 793.



TIME AND MONEY WERE SAVED when Republic Steel Pipe was used in erecting the Tremco Building, Cleveland, Ohio. Slabs were poured on ground, then gradually hoisted up 12-inch diameter pipe, by means of hydraulic screw jacks. Scaffolding, elevators, etc., were eliminated. Slabs were raised at a rate of 3′ per hour.

FOR FAST, DEPENDABLE, FASTENING in highway and building construction, specify Republic Hook-Anchor-Foundation Bolts. Various types and sizes are available to meet specific job requirements, with dimensions ranging from ½″ by 6″ (over-all length) to ½″ by 20″ (over-all length). They can be supplied with regular square nut and flat washer, not assembled — or can be furnished fully assembled, if you prefer.

THE EASE AND SPEED with which Republic Drainage Products can be installed can cut costs of drainage jobs. The complete manhole units shown were installed by the city of Ormond Beach, Florida, in less than a day. The result was a substantial saving over masonry construction. This quick assembly and installation, combined with extra long service life, make Republic Drainage Products your most economical buy.

QUICK, TROUBLE-FREE PERFORMANCE is yours when you use Republic Flexible Plastic Pipe to bring in construction water . . . or drain flooded excavations. Made of tough polyethylene, it resists abrasion and the effects of acids and alkalies. In addition, it is immune to electrolytic action. Lightweight and easy to cut or join, it can be used on job after job.

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Please send more information on:

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☐ Flexible Plastic Pipe ☐ Bolt and Nut Products

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Company_____

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Heavy Construction Operators

GO FORD-WARD for greater payload... power..

"Our Ford trucks haul up to a ton-and-a-half more payload per trip"

says William R. Collins, V.P.
William Collins and Sons, Fargo, N.D.

"We switched to Ford trucks in 1951 because we found we could haul 1½ tons more per trip. Now we have 124 Fords, including 80 T-700's. They're economical to operate, too—we get up to 6 miles per gallon. Our drivers like Ford's power steering and peppy 302 HD V-8 engine. We like Fords because we know we can always get Ford parts quickly if we need them. That means our trucks aren't down over one day, even on a major overhaul."

"We trade every two years and find that Ford trucks bring highest resale price"

says John McCormick, Sec.-Treas.
Northern Improvement Co., Fargo, N.D.

"We keep our Ford T-700's in top condition year round, and it pays off. We get a higher resale price when we trade every two years. Fords have the ability to perform under the rugged conditions in our work. Power steering on our tandem dumps makes them easy to handle on-or off-the road.

"Our drivers like Ford's power . . . they get heavy loads under way fast"

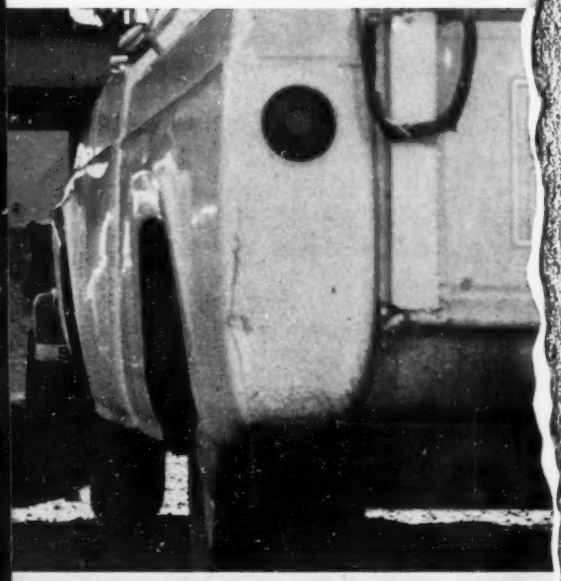
says George C. Wilson, General Superintendent
Schultz and Lindsay Construction Co., Fargo, N. D.

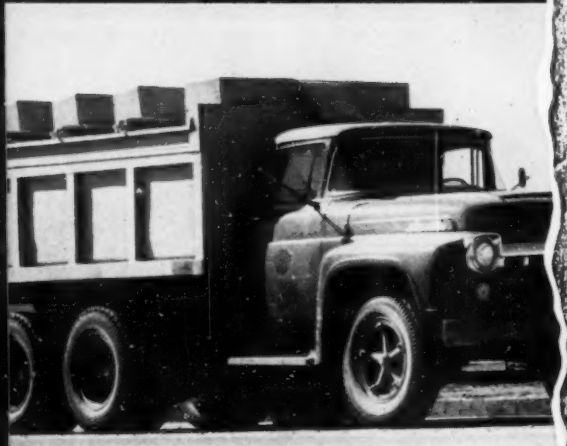
"Ford's HD power in our T-750's gets heavy loads under way fast . . . helps keep us on schedule. And we can haul bigger payloads doing it . . . up to a yard more, legally, every trip. We've never had frame trouble either. They're rugged, durable trucks and if we ever need Ford parts, we can always get them at the nearest town."

FORD TRUCKS COST LESS

LESS TO OWN... LESS TO RUN... LAST LONGER, TOO!

..resale value!





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'59 Ford Pickups Win Economy Showdown U.S.A.

—average 25.2% better gas mileage!

Impartial tests of the 1959 pickup models of all six makes prove conclusively that Ford's ½-ton pickups equipped with Short Stroke Sixes are the economy champs for '59.

HOW TESTS WERE MADE

Standard six-cylinder models of the six leading half-ton pickups first were put through exhaustive road trials. All '59 trucks—Ford and competitive—were bought from dealers, just as you would buy them. After at least 600 miles break-in, all were brought up to manufacturer's recommended specifications.

The trucks were then tested—by America's leading independent automotive testing firm—at constant speeds of 30, 45 and 60 miles an hour. Next came stop-and-go tests, ranging from moderate city traffic to normal retail delivery operation. Acceleration rates were carefully timed in each gear to insure accurate results for all makes.

HOW NEW '59 SIXES RATE IN GAS MILEAGE						
'59 FORD SIXES GIVE	25.2% more miles per gallon than Make "C"	31.1% more miles per gallon than Make "I"	9.6% more miles per gallon than Make "G"	42.6% more miles per gallon than Make "D"	22.0% more miles per gallon than Make "S"	25.2% more miles per gallon than the average of all makes

The '59 Ford Sixes, *in every test*, averaged more miles per gallon than every other make! Combining all tests, the '59 Fords led the average of all other '59 pickups by 25.2%.

WHAT'S THE SECRET?

How can a '59 Ford Six make four gallons do the work of five in other trucks?

First, of all pickup Sixes, only Ford has modern Short Stroke design. This new type of engine is basically far more efficient than long-stroke Sixes of other pickups. Example: Ford's Six delivers more usable horsepower than any other pickup Six.

Second, to this modern engine Ford has added a new economy carburetor. By metering fuel more precisely in both low- and high-speed ranges, Ford's new carburetor boosts gasoline mileage in every type of driving. And Ford's *Economy Carburetor is standard at no extra cost.*

Your Ford Dealer now has the complete report of Economy Showdown U.S.A. Why not call or visit him today and get the whole story firsthand?

How to estimate ground-water discharge

of Beth-Cu-Loy subsurface drainage pipe

Use simple formula, or nomograph on opposite page

You can easily minimize ground water dangers by the proper use of subsurface drainage structures made from galvanized corrugated Beth-Cu-Loy sheets. Pipe for this purpose is perforated to permit excess ground water to trickle in and run off to a predetermined point of deposit. But—since the size of your subsurface pipe depends on the amount of ground water to be handled—how do you estimate the potential runoff?

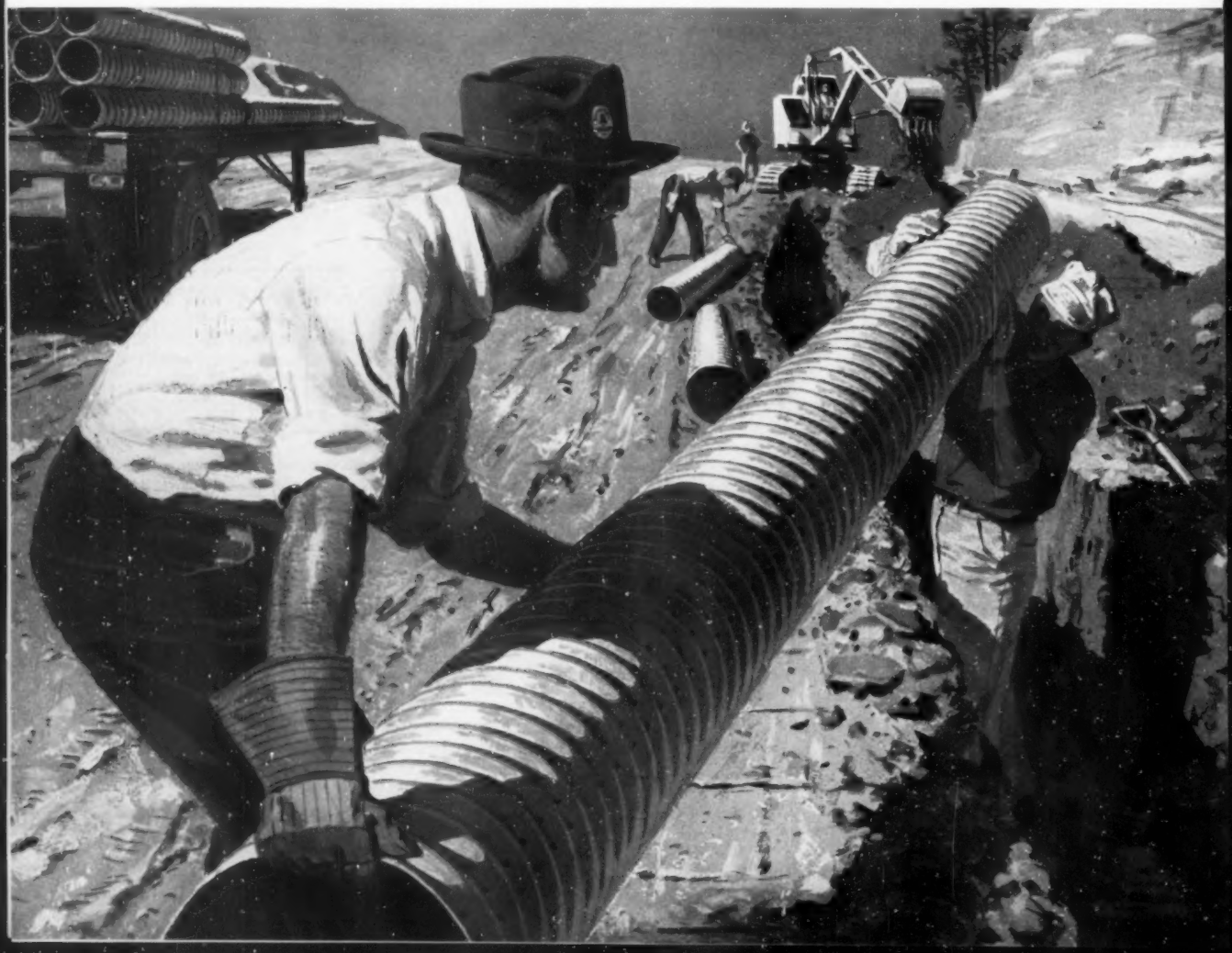
In plotting ground-water discharge under a variety of subsurface conditions, many engineers have been using the simple formula shown at the right.

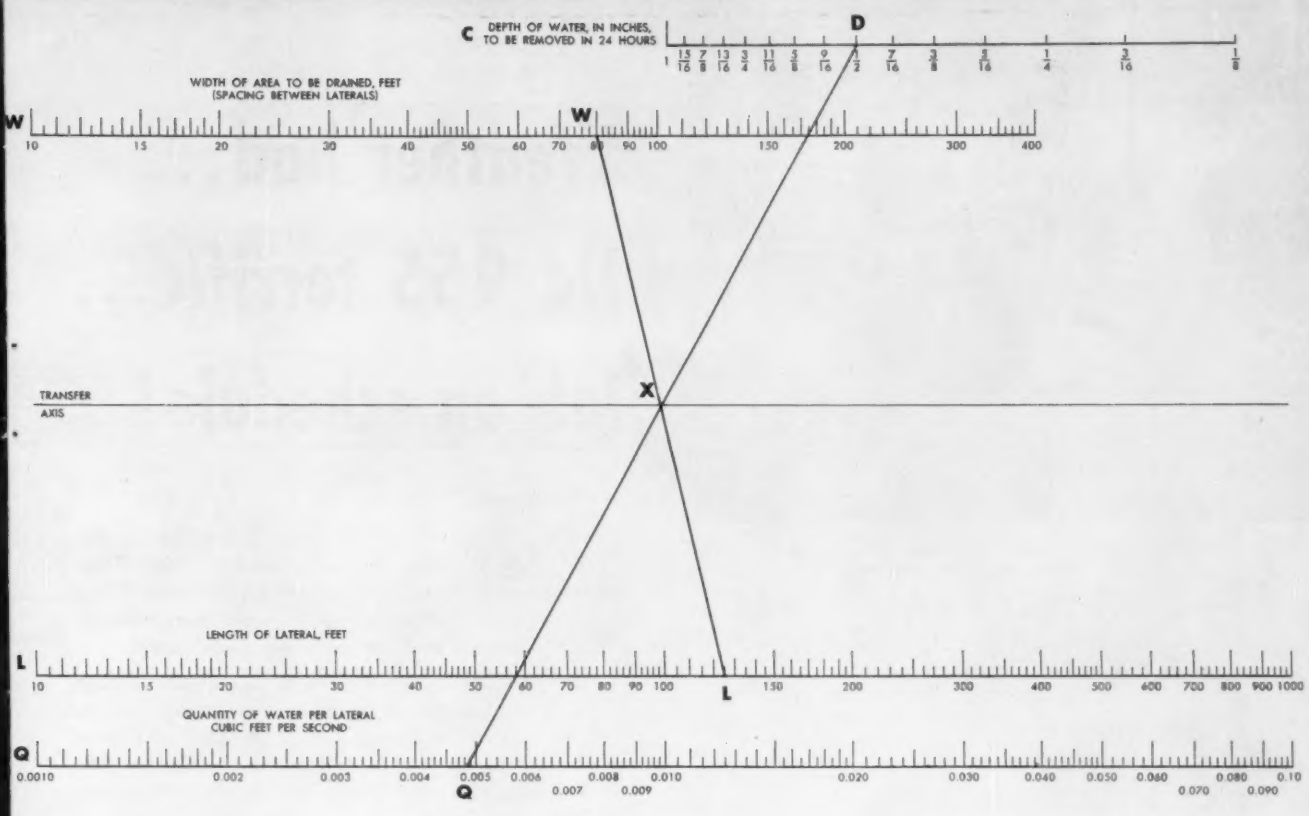
$$Q = \frac{C \times L \times W}{43{,}560}$$

where

- Q = quantity of water in cu ft per sec for each perforated pipe
- L = length of perforated pipe in feet
- W = width of area to be subdrained*
- C = a constant representing depth of ground water (in.) to be subdrained in 24 hrs (refer to table on opposite page for value of "C" to obtain cu ft per sec per acre. Your soils man can help in analyzing soil permeability and estimating the depth of water to be removed).

*One pipe only, not a network of drains.





How To Use This Nomograph

TABLE —CONSTANT C *(Subsurface Runoff in 24 Hours)*

Soil Permeability Type	Depth in.		Quantity of Water Per Lateral (cubic feet per second per acre)
	Fraction	Decimal	Constant C
Slow to Moderate	1/16	0.0625	0.0026
"	1/8	0.1250	0.0052
"	3/16	0.1875	0.0079
"	1/4	0.2500	0.0105
Moderate	5/16	0.3125	0.0131
"	3/8	0.3750	0.0157
"	7/16	0.4375	0.0184
"	1/2	0.5000	0.0210
"	9/16	0.5625	0.0236
Moderate to Fast	5/8	0.6250	0.0262
"	11/16	0.6875	0.0289
"	3/4	0.7500	0.0315
"	13/16	0.8125	0.0341
"	7/8	0.8750	0.0367
"	15/16	0.9375	0.0394
"	1	1.0000	0.0420

If you prefer to avoid arithmetical calculations, you'll find the nomograph a time-saver. Let's follow an example to see how the graph works out. Assuming an area-width (W) of 80 ft, and the length of the pipe lateral (L) to be 125 ft, draw a straight line (WL) between these points through the transfer axis line, thus establishing point X.

Let us further assume that your local soils technician has estimated that ½ in. of water is the depth to be drained in any 24-hr period. Draw another straight line from the "½" figure at point D, down through X, and extend it to the quantity line at Q. The reading at point Q shows that 0.0048 cu ft per sec of water can be expected through the lateral pipe.

Your Fabricator Can Help at This Point

With this information, your pipe fabricator can help you determine the size of pipe needed to handle the flow.

Pipe made from Beth-Cu-Loy galvanized corrugated steel sheets is ideal for subdrainage applications. It's strong, light in weight, long-lasting, and economical. Flexible, too. In all respects, it meets the rigid specs of the American Association of State Highway Officials.

Bethlehem makes only the Beth-Cu-Loy (copper bearing steel) sheets, not the pipe itself. Consult your fabricator for details on this versatile material.

BETHLEHEM STEEL

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

BETHLEHEM STEEL

No. 955 excavates part of a total of 19,000 yd., preparing for base an area 20 ft. wide, 12-13 in. deep. Cuts are made by Cat No. 12 Motor Grader and windrowed. Job is part of a $1,828,366 project by Gulf Bitulithic Co. on U. S. 75, to be part of the Interstate Highway System.

Says Operator F. H. Leggett: "I can move over 100 cu. yd. a day more with the side dump than with other loaders. It doesn't spill dirt because you don't have to jockey for position. A Traxcavator is easy to operate and I'm less tired at night. It's the best on the market."

Weather bad... No. 955 terrific... job on schedule!

The performance and versatility of a Caterpillar No. 955 Traxcavator with Side Dump Bucket was vividly demonstrated on a recent highway project in Texas. What happened is of importance to every municipal and county official concerned with the purchase of equipment.

Bad weather cut work days to 20 per cent during the first six months on a 2½-mile widening job on U.S. 75 at Conroe, Texas. A drag line proved a poor producer in the shallow cut. Switching to a Cat No. 955 Traxcavator with Side Dump Bucket, Gulf Bitulithic Co., Houston, Texas, got the job back on schedule—and kept it there! Five-yd. trucks were loaded in an average time of three minutes; four buckets to the truck.

"We increased production 25 per cent," says Superintendent Thomas "Red" Brown. "I like that Side Dump Bucket. You can't beat it."

In-line loading of trucks with the Side Dump Bucket paid off in less traffic congestion on the busy highway, and it also avoided tearing up the subgrade with twisting and turning.

Side Dump Buckets are available on all three Traxcavators: No. 977 (2¼ cu. yd.), No. 955 (1⅝ cu. yd.), and No. 933 (1⅛ cu. yd.). Other buckets, teeth, 'dozers and forks help make a Traxcavator the most versatile excavator-loader.

More and more municipalities and counties are finding the performance and versatility of Cat-built Traxcavators can save taxpayers' money. Ask your Caterpillar Dealer today to demonstrate on your operation. And remember, his reliable parts and service facilities stand behind your investment.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

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YOUR TAXPAYERS GET THEIR MONEY'S WORTH WITH CAT-BUILT MACHINES

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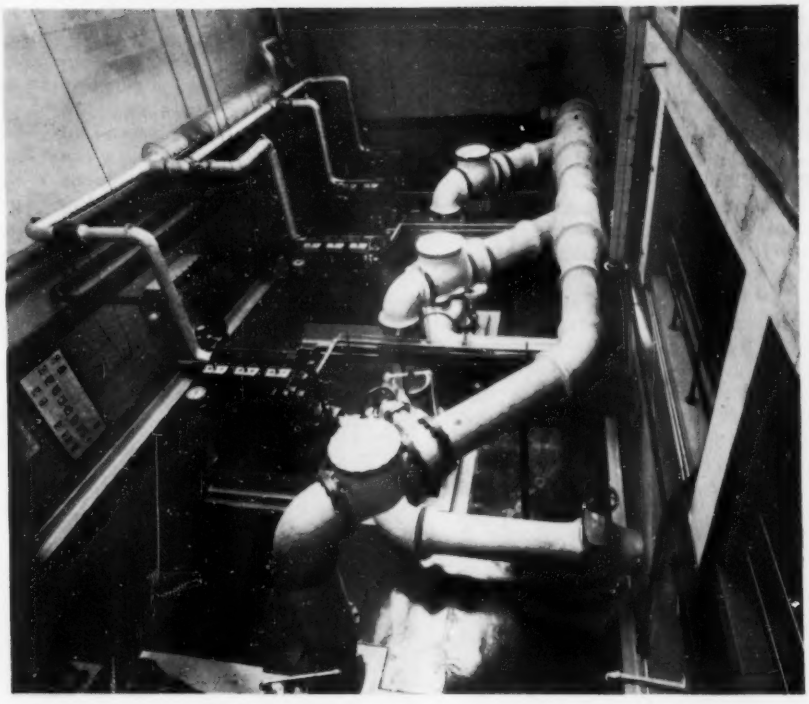


● GENERAL view of the engine room. The two engines in the foreground operate pumps; generator engines are in background; heat recovery exchangers on left wall.

22 YEARS OF EXPERIENCE with Sewage Gas Engines

WALTER A. SPERRY
Formerly Superintendent,
Aurora Sanitary District,
Aurora, Illinois

THE INTRODUCTION of the separate sewage sludge digester about 1926 revolutionized the art of sewage treatment. It made continuously available large and dependable volumes of methane gas except when reduced somewhat by prevailing weather. Plant operators were soon intrigued by the possibilities of using the gas to reduce operating costs.

Under normal operating conditions 0.8 to 1.0 cu. ft. of gas per capita is generated, with a heat value range from 630 to 650 btu. A treatment plant serving but 10,000 persons could, therefore, anticipate some 10,000 cu. ft. of gas per day. Assuming a heat value of 640 Btu (580 Btu net) gas and a conservative estimate of 13,000 Btu per brake horse power hour, a 15-18 hp engine could be operated to drive pumps, generators or blowers. Moreover 65 to 70 percent of the heat in the gas to the engine would be recoverable through heat exchangers, from the jacket water and the exhaust for digester and or building heat.

Prior to the introduction of separate sludge digesters, Imhoff tank operators were occasionally capping the tank gas vents to recover the gas. Perhaps C. C. Hommen, of Atlanta, Ga. was the earliest pioneer, heating his home with Imhoff tank gas. About 1935, Atlanta, Ga. and Johannesburg, South Africa made extensive studies as to the feasibility of fueling trucks with methane gas under high compression in steel bottles, a procedure found practical in Europe. Harold Wilson of the Johannesburg plant in 1945 studied the possibilities of converting methane gas to methyl alcohol, formaldehyde and formic acid. About 1939 the Aurora, Illinois, plant successfully dewatered an 800-foot river wall trench by removing the carburetor of an ordinary contractor's pump, substituting a gas-air mixing valve and supplying plant gas through a long garden hose. Grand

Rapids, Michigan, sold much of its gas to its neighboring railroad repair shops.

The most practical way, however, to utilize methane gas proved to be as fuel for gas engines. This fact is now so well established that engine installations are regularly included in most plant planning of any size. Unusual examples are the ten 650-hp engines in the Mogden plant, near London, England, the seven 1300-hp engines in the Los Angeles Hyperion plant, and the many large engines in the several plants in New York City. Since 1936, one of the many engine manufacturers, the Climax Engine Manufacturing Co., now a division of Waukesha Motor Co., has placed 66,200 hp in engine units for sludge gas service distributed through 23 states and in 80-odd communities.

The installation of gas engines in sewage treatment plants in the United States began about 25 years ago. The first installation in Illinois was made by W. B. Walraven at the Springfield Plant in 1933. This initial installation was a 177-hp Clark engine driving a 3300-cfm blower. It was subsequently followed by a second and larger engine. The Aurora officials watchfully stood by until 1936 before making the second engine installation in Illinois.

The Aurora treatment plant began operation in September, 1929. It was an 8-mgd plant to serve 68,000 persons. The plant included three Dorr truss type digesters, 50 ft. square and 16 ft. deep. This was among the first of the larger applications of the separate sludge digestion principle. The local sewage was wholly domestic in character and came to the plant by gravity flow. Two 8-mgd and one 6-mgd pumps were provided, driven by 75 and 50-hp motors, direct connected and float controlled. These pumps operated under a 25-ft. head to lift clarified sewage to the 4-acre stone filter dosing tanks.

Gas production in 1936 averaged 45,600 cu. ft. per day of 629-Btu (540-Btu net) quality and containing 24.4 grains per 100 cu. ft. of hydrogen sulfide. This was ample to justify considering engines. It was estimated that they would save the cost of power to operate a 75-hp motor and make use of some 2 million cu. ft. of gas wasted annually prior to the installation of the engines.

Original Installation

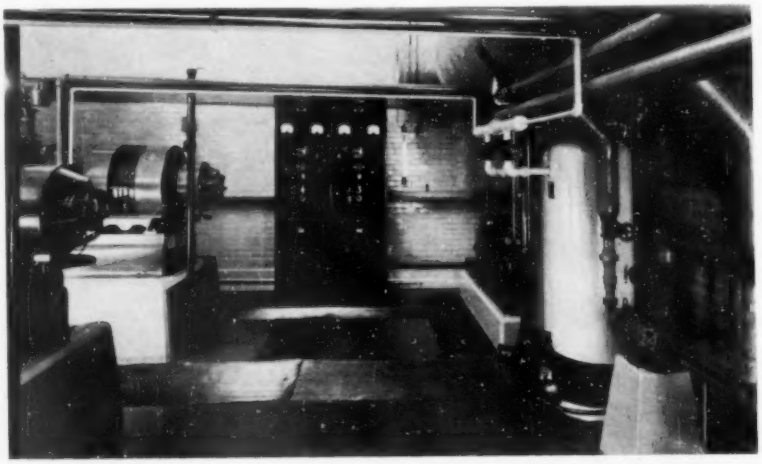
For an initial start two 75-hp, 6-cylinder, Type R6-I Climax engines were purchased, the first placed by this company in the sewage treatment field. A Whitlock water-to-water exchange heater and an exhaust exchange heater, connected in series were provided together with a Maxim silencer. These engines were set on the modified motor bases and directly connected to the two 8-mgd pumps. They were adjusted to the varying flow to the wet well by a drum type governor through cables attached to floats in the wet well. They were equipped with double spark plugs, served on one side by a battery and on the other by a magneto. The pumps speeds varied from 400 to 750 rpm, depending on the flow. Since but one of the pumps is required there is always an idle engine standing by. Generally the engines are alternated every ten days, greatly contributing to their life. These two engines are still operating after more than 22 years. The main crank shafts have been shimmed but never yet removed.

Initial experience with the pump engines was such as that in 1940 two 50-hp Climax engines with Electric Machinery Manufacturing Co. generators were installed. These engines were the air start, 4-cylinder type R4-I, with double spark plugs and dual magnetos. The pump engines were motor and battery start. The generators were 44-KVA, 35-KW, 440-volt, AC, 60-cycle. They were controlled from switch boards tied together by synchronizers so that current from both generators could be put on the bus bars if desired.

Following a 30-day trial run, the District discontinued using commercially purchased power. The two generators supplied all the plant's needs until December 1953—an interval of 13 years. By that time the load had increased and commercial power was needed.

The generator set air-start compressor was provided with both a motor and a small gas engine. Gasoline, as auxiliary fuel, was used with both engine sets. All four engines were provided with both gasoline and gas carburetors. The plant, therefore, had a quadruple factor of safety against failure, with duplicate engines, two fuels, two ways to start the generator engines and complete freedom from electric storm interruptions, due to no outside overhead wires.

In 1953, gasoline was discontinued as standby fuel and natural gas was substituted. Gasoline tends to thin the oil and foul the engines. Gas fuel tends to thicken the oil, keeps the engines cleaner; and natural gas is a third to a half cheaper than gasoline.



● **AIR START compressor and air tanks for the 50-hp engine-generators are shown at the right. Generator control panels are in background; generators at the left.**

Operating Record

As of December 31, 1957, and after 22 years and 8 months operation the two pump engines had paid for themselves, on the basis of gross cost, 4.78 times. They had earned a net of $65,406.15 and had operated 90.4 percent of the possible time, some of which did not require their use. Maintenance, supplies, auxiliary fuel and oil had averaged $679 annually per engine.

The two generator engines, after 17 years and one month had paid for themselves 2.5 times and had earned a net of $24,845.49. These engines had operated 99.58 percent of the time. Maintenance, supplies, auxiliary fuel and oil have averaged $408 annually per engine.

The excellent operating record of these four engines can be attributed to the alternating rest period, a careful annual overhaul for cleaning, valve grinding and attention to the rings, cylinder diameters and wrist pins. Both sets of engines, designed for heavy duty operation at 1000 rpm, are running at approximately 700 rpm. The pump engines rated at 75 hp are developing an average of 44 hp. The generator engines rated 50 hp are developing an average of 20 hp. Finally this record is due to the Aurora gas containing a very low hydrogen sulfide content. It has averaged 15.3 grains per 100 cu. ft. for the past 22 years. The annual range for this period has been from 39.9 grains in 1942 to 2.3 grains per 100 cu. ft. in 1957.

A review of some of Aurora's experiences through the years may be of interest. When the engines were first operated, distilled water was used in the surge tank of the closed jacket water system, to avoid scaling. In 1943 the plant water supply was used after treating with 2.8 grams of Calgon per gallon of make-up water, and since then no scaling has ever occurred.

The lubricating oil used has always been Sovac SAE 30—a high grade straight mineral oil. Since the lubrication has always been satisfactory, any pressure exerted to change to another brand or use of an additive has been resisted.

The engines were originally equipped with dual felt filters; in 1945, individual Honan-Crane filters were added on the promise of cleaner engines. In operation they saved oil as well. Such filters are now standard equipment on new engines.

The engines were also equipped with upperlube oil applicators. These were removed in 1953. Since then there have been no sticking valve rods due to hard varnish coatings. Part of the original trouble may have been eliminated by slightly enlarging the valve rod sleeves in the cylinder heads.

An Aurora practice to determine when to change oil may prove of interest. The new and used oils are compared by determining the time required for them to flow from a 50-ml pipette, with the oil temperature in each case adjusted to 20°C. When the difference in time reaches 30 percent, the oil should be changed.

Preventing Corrosion

The most troublesome and expensive problem connected with the Aurora engine installation revolved around the exhaust heat exchanger. The pump engines were the first installed by the Climax Co. for operation on sludge gas and not too much was known about the best arrangement for heat recovery, an important factor in the operation of the plant.

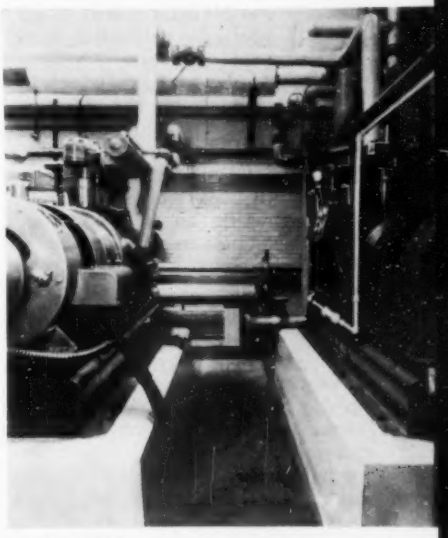
The engine exhaust heat exchanger was operated on the principle of maintaining its temperature at or above, 130°F or the so called "dew point," on the theory that above 130°F condensation would not take place and corrosion effects from the acidified water vapor in the exhaust would be slight. Despite the efforts to maintain temperatures above 130°F, corrosion of the 10-ft. long tubes persisted. Much time, effort and expense were necessary to dismantle the exchanger, lay it on its side and retube it. This operation had to be repeated every three to five years.

In 1955 the problem was discussed with a representative of the Climax Co. He thoughtfully suggested that possibly exchangers tended to be over designed. In practice, engines seldom run at full rating and more often run at considerably less than rating which was notably true for the Aurora situation. Therefore an exchanger should be chosen in sizes less than figured rather than a little larger as appears to be the tendency. He further pointed out that a dew point of 130°F does not work and that temperatures up to 250-300°F are better.

Aurora acted promptly on this advice. The exchanger tubes were cut down from 10 ft. to 6 ft. and the whole apparatus shortened four feet. It was retubed with type No. 304 stainless steel tubes. Thereafter temperatures in the exchanger rose from about 180°F to 280-290°F and to date the exchanger has given no more trouble.

The problem of corrosion in iron exchanger tubes is associated with condensation and the hydrogen sulfide content of the gas used. It was always observed that the tubes failed at those points where the exhaust temperature was coolest, i.e., near the lower ends of the tubes. The inference, here, is that corrosion would be negligible if condensation could be avoided. This would be the case where exchanger temperatures could be held at the 250 to 300° range.

The hydrogen sulfide content of the Aurora gas for the period 1936-47 averaged 23.5 grains per 100 cu. ft. In 1939-40 and for a period of four months, weekly composite samples from the exhaust heater showed an average of 110 mg/L of free sulfur acids. This much acid could account for severe corrosion if the vapor were not temperature controlled. For the period 1948-57 the hydrogen sulfide content of the gas averaged 5.3 grains. The reason for this drop is not now known. Hydrogen sulfide in sewage gas results from the sulfate content of the carriage water and the sewage becoming septic before reaching the treatment plant. Aurora's water supply is relatively low in sulfide content and its sewage arrives "fresh." While many plants must make use of scrubbers to reduce hydrogen sulfide, the Aurora experience is that plants with H_2S of 25 grains per 100 cu. ft. or less do not require scrubbers.



● **WATER-to-water heat exchangers at rear and above permit much of the heat from the engine exhausts to be utilized.**

One plant problem in connection with hydrogen sulfide should not be overlooked. It severely attacks copper and brass. Only iron pipe should be used. Periodically iron pipe tends to accumulate iron sulfide as tubercles in masses, especially at elbows or changes of direction and in sufficient quantities to stop gas flow. The pipe needs occasional hammering, to loosen these masses, and flushing. Small diameter pipe should not be used. Elbows should be eliminated in favor of crosses or tees to facilitate flushing. One set of 1½-inch pipe was destroyed from repeated hammering and sulfur deterioration at Aurora and a 2-inch pipe was substituted. Most of the Aurora gas lines are 3-inch.

The sensitivity of the pump engine governors at times has been a problem. They fail to adjust the

(*Continued on page* 200)

ASSESSMENT PAVING PROJECT

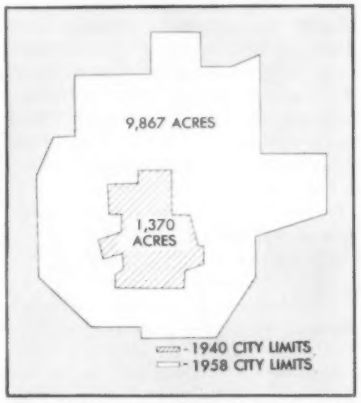
JAY W. SHARP,
Assistant to the City Engineer, Odessa, Texas

THE GROWTH of Odessa, Tex., has paralleled the rise of the oil industry. In 1920, six years before the first oil well began producing, the population was 760. By 1940, the population had jumped to 15,051; 1950, census takers counted 42,102; and by 1957, an estimated 80,000 people were living there.

As the city has expanded, the number of its streets has increased. Most of these streets have needed paving because drainage problems had to be solved, heavy traffic had to be controlled, and civic minded citizens had to be satisfied. These paving demands touched off one of the largest assessment paving projects ever undertaken in the Southwest for a city the size of Odessa. The contract for this project was awarded by the City to Brown and Root, Inc. on December 21, 1954. In June of 1955, Brown and Root, under the direction of Joe Ishy, general superintendent, began construction. Three and one-half years later, in December, 1958, after paving 559 units amounting to 44.22 miles of streets and laying 76.06 miles of curbs and gutters, Brown and Root finished their job. The total cost for the project was almost $2.25 million.

Selection of Streets

The streets to be paved were selected by one or any combination of these three bases: drainage needs, traffic conditions, citizens' petitions,



● **AREA encompassed by the city limits of Odessa, Texas, has been increased by 720 percent since 1940.**

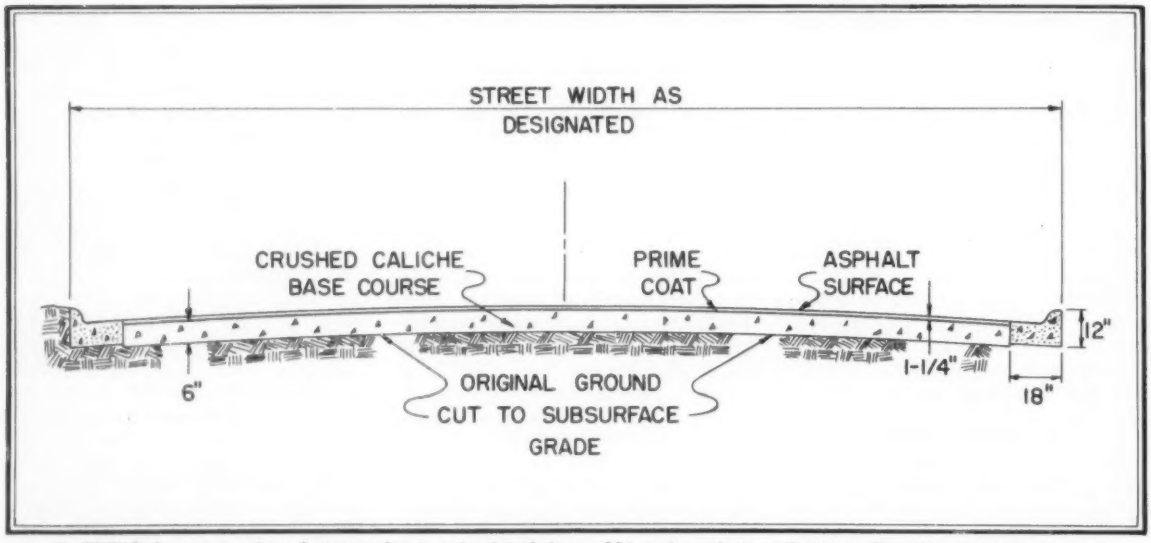
and all these had equal priority. Drainage needs were a basis in Odessa because of the general flatness of the terrain and the low permeability of the soil.

Traffic conditions were a basis because of several reasons. Heavy traffic on dirt streets was making the streets rough and often impassable in wet weather. In dry weather, heavy-traffic dust was a nuisance to homes and businesses. On the unpaved streets, traffic could not easily be directed and controlled. Traffic, in avoiding dirt streets, was concentrating on paved streets, and congestion on already-crowded streets was, therefore, increasing. And these conditions were intensifying because of the growing population.

The third and last basis for determining where new paving should be done was by citizens' petition. The City believed that the citizens wanted more paved streets, and so it hired a man especially to sound out the citizens, circulate a petition, and coordinate requests for paving. The majority of the people enthusiastically endorsed the assessment project.

The streets which were selected to be paved were designated individually as separate units. The units were grouped into a proposed phase, i.e., a series of units, and presented to the City Council. The Council passed a resolution initiating action on the phase, and this action took the form of planning, public hearings, more resolutions, and other steps preliminary to construction. When the preliminary steps were completed, construction began.

The streets which were paved ranged from 33 to 60 feet wide, and had a 6-inch caliche base topped by



● **TYPICAL cross-section of streets showing the 6-inch base, 1¼-inch asphalt surfacing and curb and gutter section.**

MATCHES GROWING POPULATION

a 1¼-inch layer of hot-mix asphaltic concrete. Construction followed a typical procedure: Excavation; pouring curbs and gutters; laying base; priming; and surfacing.

The excavation was done with scrapers and motor graders. This equipment was all that was needed because of the flat terrain and the usual absence of rock. Motor graders and pneumatic rollers shaped and compacted the natural earth for subbase.

For curbs and gutters, the concrete test minimum was 2000 psi.

● **CURBS and gutters were poured following excavation. Expansion and dummy joints were placed at intervals.**

In order for the concrete to meet the minimum test, specifications were set for such things as the type of cement to be used, hauling and storage conditions for the cement, coarse and fine aggregates, and mixing water. The general dimensions for the curbs and gutters (which were of the typical "L" shape) were as follows: 12 inches from top to bottom, 18 inches from back to front, 11 inches from front of gutter to front of curb, and 6 inches from top of gutter to bottom. The lay-down curbs, which were placed in driveways, measured 6⅜ inches from top to bottom. The gutter dimensions remained the same. Finished curbs and gutters were to have ½-inch premoulded expansion joints placed at intervals not greater than 40 feet and dummy joints cut at 10-ft. intervals. All exposed surfaces had a troweled finish followed by light brushings. Finally the curbs were backfilled, and the right-of-way was cleaned and neatly finished about them.

The base was a crushed limestone caliche, which was hauled in by dump trucks, spread, bladed and rolled to grade. Pneumatic rollers, 10-ton three-wheel rollers, and 10-ton tandem rollers were used. After the base was satisfactorily shaped and cleaned, the prime coat was applied. The prime—type MC-1 cutback asphalt—was distributed at 0.25 to 0.30 gallon per square yard at a temperature of about 300°. For better bond between the hot-mix surfacing and the base, a tack coat usually preceded the surfacing.

The hot-mix asphaltic concrete surfacing, which was Texas State Highway Department type "D" (top size aggregate equaling ⅜-inch), was applied with a Barber-Greene finishing machine. The specifications for the asphaltic concrete were: a density of 94 to 98 percent and a stability of not less than 45 percent. An interesting point arose in rolling the asphalt. In the beginning of the program, rolling was done with only a three-wheel roller and a tandem roller. This rolling combination produced a density of just 88 percent—6 percent below the required minimum. A pneumatic roller was added to the combination to introduce a kneading action into the rolling. The optimum density of 96 percent was attained.

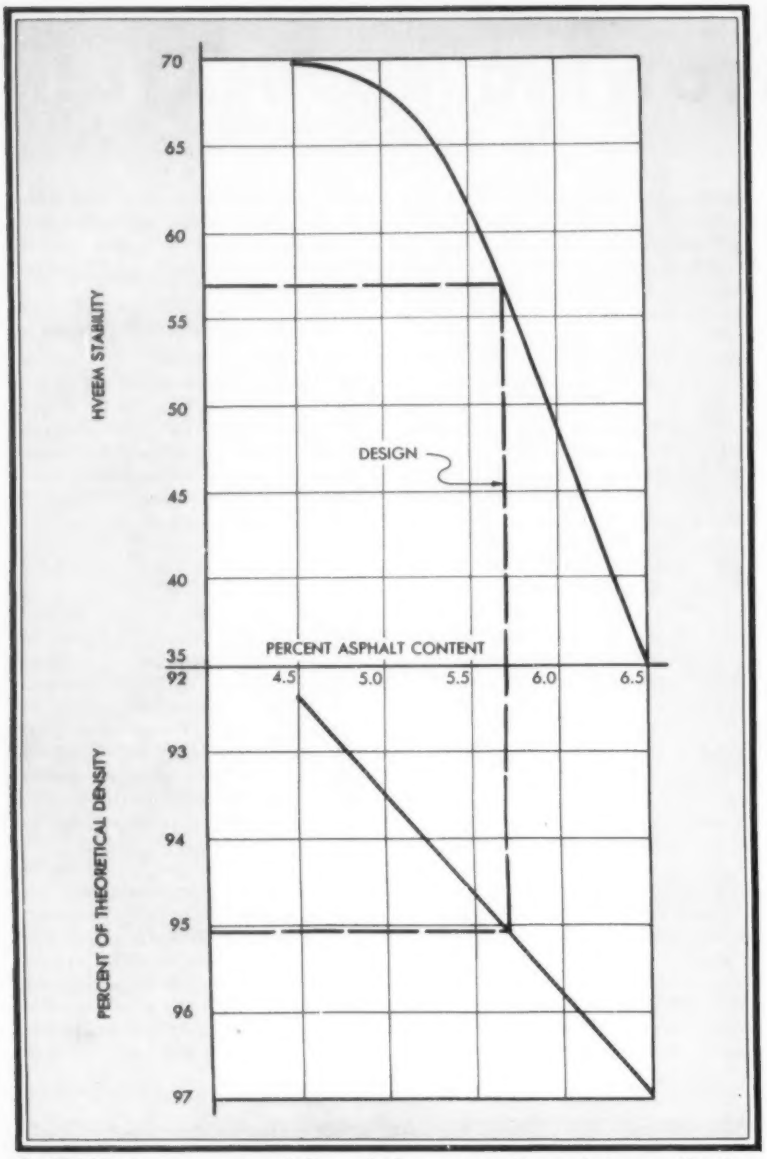
Costs and Public Relations

As was said earlier, the costs for the Odessa assessment paving program totaled almost $2.25 million. The following gives a partial breakdown of costs and quantities: Square yards of pavement, 959,811.21; linear feet of curb and gutter, 401,618.20; cost to city, $585,177.96; cost to property owners, $1,661,891.44; and the total cost was $2,247,069.40.

The City paid the Contractor for ten percent of the paving between the curbs and gutters and for all paving of the street and alley intersections. The City also paid for incidental costs such as laboratory fees, relocating utilities and miscellaneous work. The part of the total cost paid by the City equaled slightly more than 26 percent, and most of this percentage was paid from tax bonds.

The fact that the City paid for paving intersections coupled with the fact that it levied assessments on the basis of square yards of paving served an important purpose. In the first place, owners paid only for paving done adjacent to their property. This, of course, made their costs less than if they paid for pav-

● **FINISHED street, showing surfacing, which varied in width from 33 to 60 feet, curbs, driveway entrances and sidewalks. City portion of cost was about 26 percent.**



● **GRAPH shows percent asphalt required to meet optimum design specifications.**

ing intersections, too. Owners were, therefore, more willing to take part in the assessment program. And in the second place, assessments could be levied uniformly for each linear foot adjacent to a given width of street to be paved. As a result, assessments were levied on a uniform basis throughout the city. The upshot was that no owners felt badly because they were assessed more in proportion than someone else, and the City gained a beneficial step in public relations.

The City also followed another practice which proved helpful in public relations. In addition to the usual publishing of notices about proposed improvements in the legal section of the newspaper, the City sent letters to property owners to inform them of the proposed improvements. These letters informed owners of the location of proposed improvements, described their property, listed the exact assessments per front foot, and outlined a payment plan. The results of the letters were that property owners were better informed of proposed improvements, and most owners appreciated the individual consideration.

The assessment paving program alone (exclusive of development paving) accounted for a 35.5 percent increase in Odessa's total paving mileage since 1955. The City of Odessa feels that the entire program —selecting streets to be paved, steps preliminary to construction, actual construction and relations with property owners—was an example of a municipality meeting the engineering demands of a rapidly growing population.

• • •

TRACTOR FLEET Is Matched to Jobs

THE EXPERIENCE of Greensboro, N. C., in the operation of its fleet of tractors offers a workable time and cost savings study for municipalities everywhere. Three different sizes have been selected, each for a specific job, to furnish power for the city's departments of parks and recreation, cemetery, sanitation and water and sewer department.

Officials report that the International Cub Lo-Boy tractor, with a speed range of from 2.3 to 6.9 mph, plays an important role in maintaining and landscaping Greensboro's many beautiful parks. Two of these 10 dph tractors equipped with center-mounted mowers handle requirements of the park, recreation and cemetery departments.

Two International 130 tractors in the 20 drawbar hp class, equipped with five-foot side-mounted cutter bar mowers, are employed full-time at roadside banks, highway right-of-ways and parkways. The machines also are assigned to any other area, public or private, important to the upkeep of Greensboro.

A still larger International 350 diesel, equipped with backhoe and front-mounted hydraulic loader, is used by the water and sewer department. Main function of this 40 dhp tractor is laying many miles of lateral water and sewer lines, maintaining old ones, and installing sections of main lines too short for contracting.

Vacuum Filtration of Sludge at Cranston, R. I.

During the fiscal year ending Sept. 30, 1958, the Cranston, R. I., sewage treatment plant filtered 3.68 million gallons of elutriated sludge on two vacuum filters. The sludge, with an average solids content of 3.46 percent, was dewatered at an average rate of 3.05 pounds per square foot of filter surface per hour, using 6.16 percent of ferric chloride, based on dry solids. The average moisture content of the filter cake was 82.85 percent. Walter C. Anderson is Superintendent.

PORTABLE STILLING WELL for Measurement of WEIR DISCHARGES

THOMAS P. QUIRK,
Engineer,
Malcolm Pirnie Engineers,
New York, N. Y.

A NUMBER of the wet process industries in present operation employ open channels or ditches to transport their spent waters to receiving streams or municipal sewers for eventual disposal. Unfortunately, in the initial layout of the production facilities little consideration was normally given to the construction and location of waste bearing channels to facilitate the sampling and measurement of the process discharges. As a result, the channels encountered are often narrow, deep flumes, located in inaccessible areas. Under these conditions the construction of proper sampling and metering devices requires an appreciable expenditure of time and money.

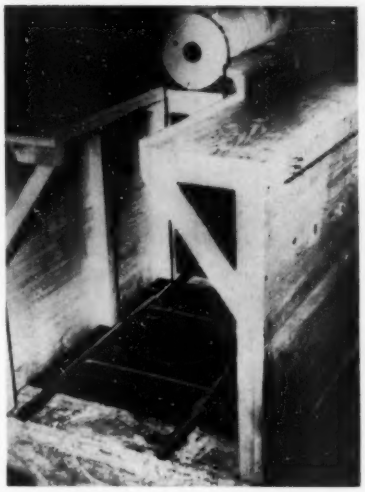
For a waste survey, accurate measurement of the discharges carried in open channels can be made by employing a weir and a float-operated level recorder. To insure a legible record of head over the weir the sensing float is usually enclosed in a stilling well designed to dampen the fluctuations in discharge accompanying industrial operations.

The construction of a chamber to house the weir, stilling well and attendant approach baffles, usually requires an enlargement of the waste channel to a width several times the original dimension. Where the channels are located in concrete floors or in other inaccessible areas, with no bypass conduits available, production must be halted to permit the necessary construction.

When such conditions are encountered the use of a portable, self-supporting stilling chamber and recording device can greatly facilitate the conduct of a waste survey and do much to avoid unnecessary interruption of production.

Details of Design

In a recent industrial-waste survey of several midwestern paper board mills, the necessity for such a device became obvious. To provide

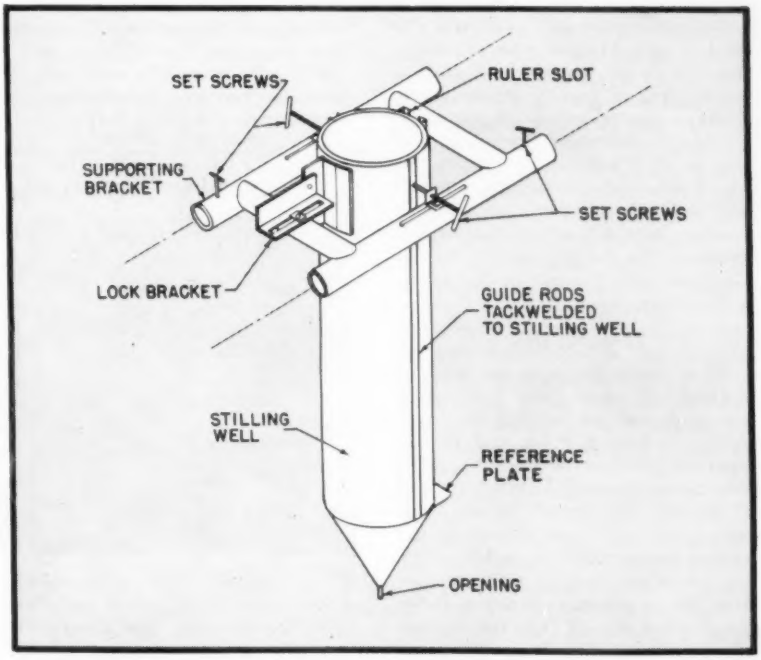


● **STILLING well can be located over any floor opening and in any position.**

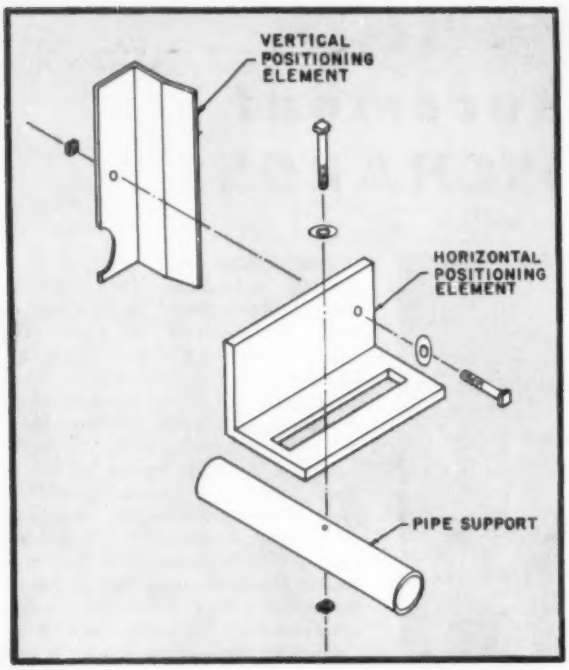
a portable, easily assembled, non-obstructing device, requiring no special training for installation and operation, the stilling well and support shown in Figure 1 was constructed.

The stilling well consists of a vertical cylindrical tube, formed from a light-weight steel alloy, of sufficient diameter to house the sensing float of the level recorder. The bottom of the chamber is fitted with a conically-shaped inlet ending in an aperture of approximately 1/1,000th of the area of the cylindrical tube. A small horizontal reference plate was welded to the stilling well at a point near the beginning of the conical section. Metal, frame-type guides extending from the horizontal reference plate to the top of the cylinder, form a slot which holds a calibrated rule whose zero coincides with the surface of the reference plate.

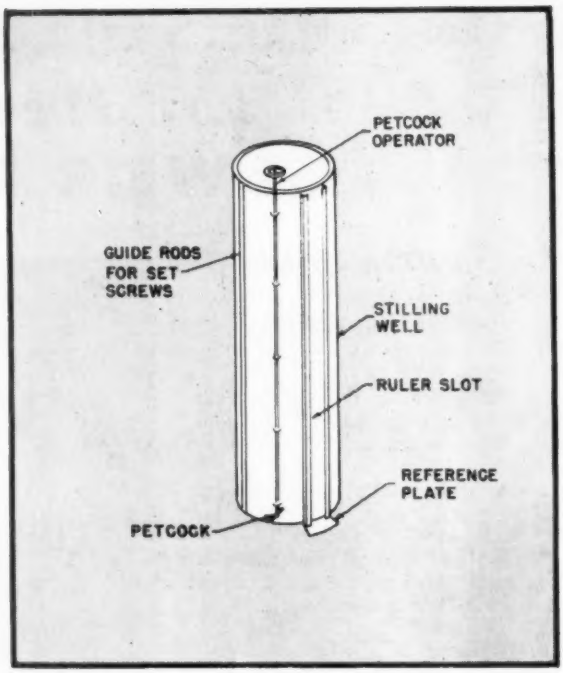
The stilling well is held in place by a rectangular pipe-bracket support connected to the well by a pair of set screws mounted on the longitudinal sides of the supporting pipe-bracket. A pair of guide rods, between which the set screws were driven, were tack-welded to each side of the stilling well to insure a stable connection to the supporting pipe structures.



● **FIGURE 1. Construction of the conical stilling well and supporting bracket.**



● FIGURE 2. Detail of lock bracket on the pipe support.



● FIGURE 3. Flat bottomed stilling well has a petcock.

The entire assembly, consisting of stilling well and pipe-bracket, is supported by two lengths of rod, which are fitted inside the pipes that form the sides of the rectangular supporting bracket and are laid horizontally on the ground. (In Figure 1 the rods are indicated by dashed lines.)

To provide additional support for the stilling well and allow for horizontal movement and rotation of the well a lock bracket was placed in one end of the transverse pipe supports. The vertical positioning element is swivel-mounted to adjust to any non-vertical installation of the stilling well. Slots grooved in the horizontal positioning element and the pipe supports under the set screws, permit longitudinal adjustment of the stilling well to its desired position for use in the measurement studies.

Installation

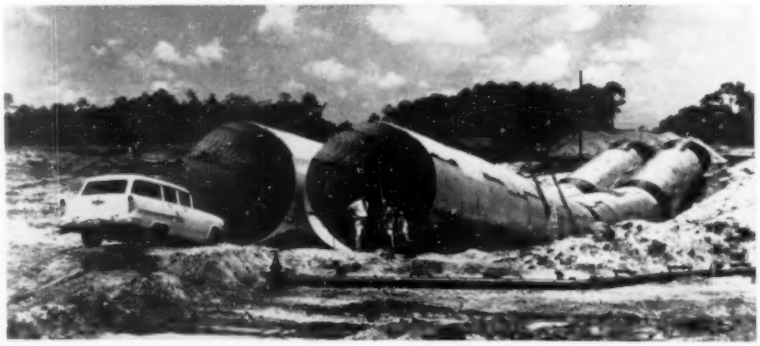
With the supporting mechanisms shown on Figures 1 and 2, the stilling well can be located over any shape of floor opening and in any position relative to the weir. The vertical positioning element permits a vertical installation of the well regardless of the inclination of the rods supporting the assembly. Once located in the desired general location, the well can be brought under the head recording gage through an adjustment of the horizontal motion devices.

In locations where frequent exposure of the recording chart would damage the flow record, the horizontal reference plate was set at the same elevation as the crest of the weir or at a convenient elevation in relation to the weir crest. The depth of flow was then read directly from the calibrated rule. The calibrated rule also provided a convenient method of checking the accuracy of the pen setting on the level recording chart.

When the assembly was installed in locations experiencing radical surges in flow a petcock (Figure 3), was used to close the connection between the liquid level in the stilling well and the fluctuating level in the channel. In this manner, "hunting" of the level in the stilling well was arrested and the meter float was set accurately in relation to the level above the weir crest. After the initial setting the petcock was opened and the recorder accurately transcribed the variations in head.

The use of the portable stilling well permitted the accurate measurement of waste discharges with a minimum of installation and calibration time.

Vehicular Underpass for Daytona Speedway



TO PROVIDE access for spectator traffic to the infield of the Daytona International Speedway, this vehicular underpass consisting of twin lines of Armco Multi-Plate pipe was installed. Each line is 14 ft. dia. and 250 ft. long, with asphalt caulking in lap seams to eliminate infiltration. Minimum load permits close spacing of pipes.

● POWER saw cuts nipples from pipe ends preparatory to starting cleaning.

CLEANING EXISTING WATER MAINS

Eliminates Need for New Ones

CLYDE SMITH,
Field Superintendent,
Ace Pipe Cleaning Company,
Kansas City, Missouri

BY CLEANING approximately 52,000 ft. of 4 to 10 in. water mains, Carmi, Illinois has been able to supply appreciably more water to users living on the fringes of its distribution system, and has eliminated an acute shortage that had been responsible for numerous complaints during the summer months. Reduction of pressure losses has not only increased the flow to users, but has added to the supply available at hydrants. This latter improvement is expected to help produce a healthy reduction in fire insurance rates for Carmi residents within the near future.

The mains comprising approximately half its water distribution system were cleaned in the spring of 1957 by Ace Pipe Cleaning Company. The water system serves about 7,500 users, with 1,000 customers located beyond the corporate limits.

The city draws its water from the Little Wabash River, which flows through the center of town. After being processed in a 2-mgd filtration plant, the water is fed into a loop-type distribution network, through a system of 8 and 10-in. lines, by four pumps with a total actual capacity of about 2300 gpm. Storage is provided in a 120-ft. elevated tank, holding 150,000 gals., which rides on the system.

Much of Carmi's distribution system was laid at the turn of the century. From then until 1928, water was taken from the river, chlorinated, and piped direct to the user. Thick sedimentary and tubercular deposits formed in the pipes during this period. Then, in 1928, the filtration plant was built, sharply curtailing additional build up.

Although deposits had appreciably reduced the original carrying capacity of the water mains, users were able to obtain sufficient water until recent years, when a number of homes were built just outside the corporate limits. The mains were extended to serve these new areas, but not enough water could be drawn through the original lines to supply the volume of water demanded by this increased load.

Benefits Realized

It was apparent to William C. Huber, Supt. of Distribution, that a main cleaning project would be less expensive than installing new mains. Accordingly, the project was carried out. After cleaning the mains, Mr. Huber observed that the amount of water supplied to the outskirts during the peak-demand summer months was increased by at least 30 percent. The cost of rehabilitation totalled approximately $13,000, about one-twentieth of the cost of new mains capable of providing the same increased volume of water to the area beyond the city limits

Before the mains were cleaned, water pressure at the plant was 54 psi, and 18 psi. at the points in the distribution network farthest from the pumps. In these areas many users frequently were without water during peak-demand periods. Others obtained only a trickle when they turned on their taps. Between 35 and 40 percent of the customers living in the fringe areas would complain about the inadequacy of their water supply at least once during a typical summer.

After the mains were cleaned, pressure at the extremities of the distribution system rose, on the average, from 18 to 38 psi. Significantly, this improvement was accomplished without adding to power cost for pumping; and complaints have dropped to the vanishing point.

Another benefit is the improvement in hydrant pressures. Before the mains were cleaned, Carmi was on the verge of being reclassified for fire insurance purposes into a higher category. Now the city has high hopes of getting a rate reduction.

Plans are being made to erect a standpipe (supplementing the existing elevated storage tank), and some 2800 ft. of new mains. When this work is accomplished, Carmi will be eligible for a Class 6 rating from the National Board of Fire Underwriters, versus its present Class 7 status. This change will mean a reduction of up to 25 percent per thousand dollars of coverage in the fire insurance rate paid by residents.

Cleaning Procedures

The water main cleaning procedure employed in Carmi involved use of a chain-head auger for hard sedimentary deposits. The auger is connected to a power unit on a truck by a flexible steel line. To remove tuberculation, a disk scraper

is pulled through the pipe by means of a power winch.

Before a pipe section is cleaned with the scrapers, pits are excavated at either end, and all branch lines are closed. The bottom of the pit is about a foot below the pipe invert, and the horizontal cross-section measures approximately 6 by 4 ft. After the pits are dug, the water flow is shut off, and a nipple approximately 3 ft. long is removed with the aid of a power saw at either end of the section. The cleaning tool is inserted at the upstream end, and the pipe that has been taken out at this point is replaced using Dresser couplings. Next, the water shutoff valve is opened. The tool, pushed by the flow and pulled by the towline, proceeds through the pipe.

As the water, loaded with deposits, flows into the pit at the downstream end of the section, it is removed by a portable pump and conveyed to a storm drain by fire hose. Solids deposited in the bottom of the pit are shoveled out.

The cleaning procedure employed with the chain-head auger is basically the same as that described above except that the nipple at the upstream end of the section is not replaced immediately, and no water flows through the pipe while the cleaning operation proceeds. After the auger reaches the downstream end of the section, however, it is drawn out, and the nipple at the upstream end is replaced. Afterward, the shutoff valve is opened, and the pipe is flushed. Water and debris that collect at the downstream end are removed as explained above.

Either tool can clean pipe sections up to 3000 ft. long at one time provided it does not have to travel around any bends greater than 45 deg. If it does, pits must be dug, and the pipe must be opened on either side of the bend. The tool travels through the pipe up to the entrance to the bend. Here, the auger or scrapers are removed, and, after being inserted on the other side, they continue the cleaning operation. The pipe comprising the bend itself is cleaned manually, or with the tool as a separate operation. No extra cuts were required, in Carmi's case, for 45 deg. bends, long radius elbows, crosses or T connections (where the tool could continue in a straight line through the cross or the T).

All excavation and backfilling work was done with city forces and equipment. As each section was cleaned, all valves were inspected, and defective units were replaced. The $13,000 total cost of the job includes expenditures for these items, as well as the fee paid Ace Pipe Cleaning Company. Pipe runs were relatively long, averaging 2,000 ft. each, which kept the amount of excavation down to a minimum.

● **CLEANING the water mains permitted increase of 30 percent in water delivered to outskirts of Carmi and water pressure at ends of mains rose from 18 to 38 psi.**

Supt. Huber is convinced that the improvement in service to the fringe areas of the city has been more than enough to repay the entire cost of the job.

• • •

Sewage Re-Use Considered at Los Angeles

It is estimated that by 1965, water shortages will occur in Los Angeles County unless waste water reclamation is developed as a significant source of water. Of the 465-mgd sewage discharge of the city, 280 mgd can reasonably be reclaimed and reused for ground water recharge, industrial, agricultural or recreational purposes. To demonstrate the economic and esthetic feasibility of reclaiming water from sewage, it is proposed that a $1,500,000 plant, designed to provide 10 mgd of sewage suitable for recharge to ground water basins, be located in the impounding area behind the Whittier Narrows Dam.

Information obtained from the operation of the demonstration plant will be supplemented by experience at three sewage treatment plants now operated by the Los Angeles County Sanitation Districts for water reclamation purpose. Information is also available from tests made by the County Flood Control District and the City of Los Angeles in their Manhattan Beach Ground water recharge experiment for preventing salt water intrusion.—From a paper by F. R. Bowerman, Assistant Chief Engineer, County Sanitation Districts of Los Angeles County, at the Los Angeles ASCE convention.

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Data on the Nevada Highway Department

In 1956-1957, 55 new maintenance units and 49 replacements were purchased costing $448,979 by the Equipment Division of the Nevada Highway Dept. In 1957-1958, 59 new units and 80 replacements were purchased at a total cost of $558,855. The Highway Department communications system has grown considerably since its inception in 1954 and now consists of 233 mobile units, 8 mountain-top repeater stations and 27 base stations.

In June, 1956 there were 185 professional engineers on the payroll. Since that time the figure has increased to 200. During the same period total personnel has increased from 896 to 1,052.

What About TRAFFIC ENGINEERING In Smaller Towns?

THERE ARE many ways in which a town may put traffic engineering practices into action. If the town is large enough, the most desirable course is to secure permanently the services of a trained qualified traffic engineer. If this is possible, contact should be made with the Institute of Traffic Engineers and the particular needs and conditions be made known.

Many towns, unable to justify the full-time employment of a traffic engineer, retain consultants on a part-time basis. This plan has rapidly gained favor in certain areas where it is convenient for the person to rotate his time among several towns. Of course, this requires that not too great a distance separate the towns being served.

A natural question is, "How could a person of these talents serve the needs of my own locality?" Perhaps the most important consideration is that he base his conclusions and decisions on facts and needs. The traffic engineer knows how to collect and present the facts to "sell" needed improvements. If one-way streets are needed, he can supply figures justifying this need. In a similar manner, he can scientifically combat public pressure or opinion as to projects or items not needed.

The flow of traffic can be thought of as being similar to the flow of a river or stream. The flow varies in volume and intensity; it sometimes changes course; and, most important, it can be measured. The results of these measurements thus become the chief tools of the engineer in applying corrective measures. They may indicate such things as the need to change the timing of a signal or additional off-street parking requirements. They are basic in designing traffic signal systems for uninterrupted flow and maximum efficiency of intersection capacity.

Traffic Control Devices

The traffic engineer has many tools in his possession in the form of modern traffic control devices. For example, in the signal field alone advancements have been made of which the general public is unaware. You may have only three or four signals on the Main Street but there is no reason these could not be interconnected for uninterrupted traffic flow as is done in most major cities. There might be one major intersection loaded to capacity but strangled with poor signal efficiency. By changing to automatic or actuated equipment (whereby the volume of traffic on each street determines the timing of the signal), good results may be obtained. There have been cases known where this type of equipment can actually move more traffic faster than if a police officer were stationed at the intersection. Expensive? Not necessarily, when consideration is given to the delay eliminated for the driving public.

Realistic Speed Limits

Most motorists have respect for traffic laws and regulations for which they understand the need and with which they agree. One of the greatest abuses in the past has been in speed zoning: for example, extending a 30 mph zone to a corporate limit although the corporate line may be quite a distance from a built-up area or even in open country. The results of traffic engineering studies have positively indicated that motorists will set their own speed which they think is safe and correct regardless of what speed limit signs may be posted. Far from being considered a bad thing, this characteristic or driving habit has been used to advantage as a means of setting a logical and reasonable speed zone.

The traffic engineer uses an "85 percentile" speed (the speed at which 85 percent of the public is driving at or below) as a basis in setting a proper speed limit. Thus 85 percent of the people are automatically driving within the limit set and complying with the law. The motorist, when entering a zone such as this, consciously or sub-consciously has a feeling of respect rather than undue restriction. He agrees with the limit as it coincides with his own speed. To him it is right and proper and he is more apt to obey all traffic regulations. Aside from the benefits received in the field of traffic control, the public relations returns are invaluable.

Use of Paint

Sometimes the use of a bucket of paint can be instrumental in resolving complicated intersections. Most every town has one or more of these where chaos reigns supreme, resulting in inefficient traffic movement as well as accidents. The traffic engineer employs "channelization" as a means of defining definite paths or routes for all vehicles, thus simplifying decisions for the motorist. This is done by studying carefully all traffic flow movements from traffic counts followed by various experimental designs on the drawing board. Usually the plan considered best is tried on a temporary basis, outlining the islands by use of paint or sand bags. Following a trial period indicating the intersection to function successfully, the sand bags are replaced by permanent structures such as concrete curbs.

The field of traffic engineering itself is too broad to attempt to give specific examples of all the functions involved. The preceding examples were given merely to emphasize some of the results possible in any sized town. Many towns, unable to obtain either a full-time engineer or part-time consultant, invest the authority or function in one of their own people, existing employees or departments. It is highly desirable that such person have specialized training. This is available through many colleges and universities as a one-year graduate course. Most of these schools offer fellowships and are especially desirous of obtaining students currently employed by towns and cities who will be likely to return to their former positions. In addition to training, also important is the authority given him and

the position in the framework of the city government assigned the function.

When not set up as a separate department, this function has been placed variously, as with the city engineer, street department, department of public works or police department. Being basically an engineering function, it is more logical that it be under the city engineer. Certainly, it will serve best where the need is recognized and understood.

In the initial phases of organization, administrative problems are inevitable in that it may be necessary to dislodge some functions from their former position in the city government structure. For example, the traffic engineer will certainly require the service of signal electricians, many of whom might have previously been located in the electrical or police divisions. He cannot be successful if the various personnel required are allowed to continue to serve under the supervision of others. It is imperative that he receive the cooperation of other city departments and, if possible, be placed on the same level with other department heads.

While traffic engineering activities are generally thought of as being confined to large metropolitan areas, it is hoped that this article has demonstrated the feasibility of their function in smaller towns. Such organizations as the Institute of Traffic Engineers, Automotive Safety Foundation, American Automobile Association, Eno Foundation and many others are able to lend advice and assistance in various aspects of this field. Many states offer staffs of trained personnel to conduct various traffic studies for cities on a cost-participation basis. All of these aids are available to the smaller town or city for the asking.

PERSONNEL SAFETY on the OHIO TURNPIKE

BENJAMIN H. BOWMAN,
Traffic and Safety Engineer,
Ohio Turnpike Commission

THE OHIO Turnpike has an enviable record with regard to the safety of its maintenance workers. Not a single worker has been killed or seriously injured in the performance of maintenance duties in the entire operation history of the 241-mile Ohio Turnpike. The first section of the turnpike, a 22-mile stretch, opened on December 1, 1954; the remainder began to receive traffic on October 1, 1955.

A complete program to insure safety in maintenance operations was instituted by the Commission under the direction of the author who is its Traffic and Safety Engineer. Regulations which all workers must follow when employed on the roadways, the most dangerous place of exposure, are compiled in a booklet: "Standard Procedure for Maintenance and Construction Operations Under Traffic." The specified methods of safeguarding employees (and, of course, turnpike traffic, too) are listed in condensed form below:

1) Equipment (except while being used) shall never be parked anywhere along the roads except on the right-hand shoulder or on the grass area beyond, completely off the traffic lanes.

2) Equipment must always operate in the direction of traffic unless specific permission to do otherwise is obtained.

3) Maintenance vehicles, before crossing medial strip, must pull over on right-hand shoulder and wait for clear passage. Such crossings must be kept to a minimum.

4) No construction work involving occupancy of travel lanes or shoulders shall be done during darkness, bad weather or on weekends, except by special permission.

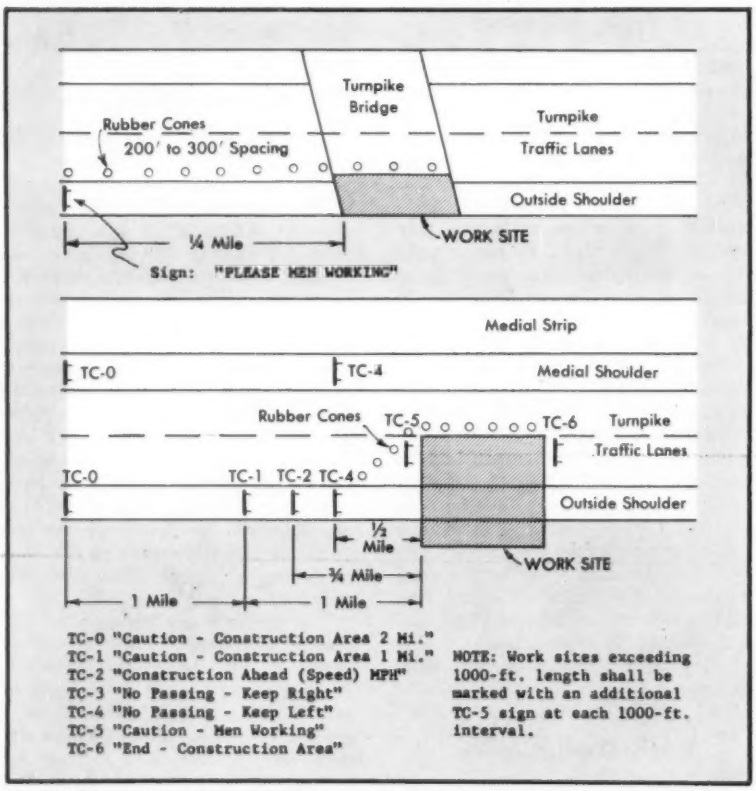


DIAGRAM illustrates prescribed use of signs in relation to repair and maintenance zones. The same plan is followed in marking work sites next to the medial strip except that the devices are placed on the medial side of the traffic lanes.

Personnel safety is a highly important consideration of public works engineering and management. This is one of a series of articles on the subject. These have been prepared by leading engineers at the request of the Editors of PUBLIC WORKS. Subsequent articles will cover such activities as water works, sewerage and refuse collection and disposal, plus other aspects of highway construction and maintenance.

5) No equipment, other than that designed for highway transportation, shall be moved on the turnpike at night or under adverse traffic, weather or roadway conditions.

6) Workmen shall not cross traveled lanes without using extreme caution.

7) All equipment operating on the turnpike shall have a red flag mounted on both the left and right rear sections.

8) Whenever workmen are employed within five feet of the outside shoulder, "Please—Men Working" signs and rubber cones shall be placed in advance of work areas (as prescribed in detail in the "Standard Procedure"). In no instance shall work on the main roadways obstruct more than one traffic lane. When equipment is continually advancing, flagmen and red flashing signal lights must be used, with the flagmen on foot or on a vehicle located 500 to 800 feet behind the operating equipment.

9) Flagmen shall use a red flag at least 18 ins. square, shall perform duties courteously, and shall not stop traffic unless necessary for the safety of all concerned.

10) Signs and rubber cones shall be removed at the end of the work day unless state of work requires continuation of warning devices in which case the Traffic and Safety Engineer may prescribe additional safety measures.

11) Any earth, gravel or other material spilled on traveled lanes or shoulders shall be immediately removed, with traffic adequately safeguarded during the period of removal.

12) Materials may not be stored on traveled lanes, bridges or shoulders.

13) Maintenance vehicles used on the turnpike must be equipped with two red flashing lights for use when equipment is stopped on shoulder or is operating at less than normal traffic speed. Red flags may be substituted for flashing lights on mowers.

In addition to these procedures, the Ohio Turnpike Commission pursues rigid safety policies with respect to other maintenance activities.

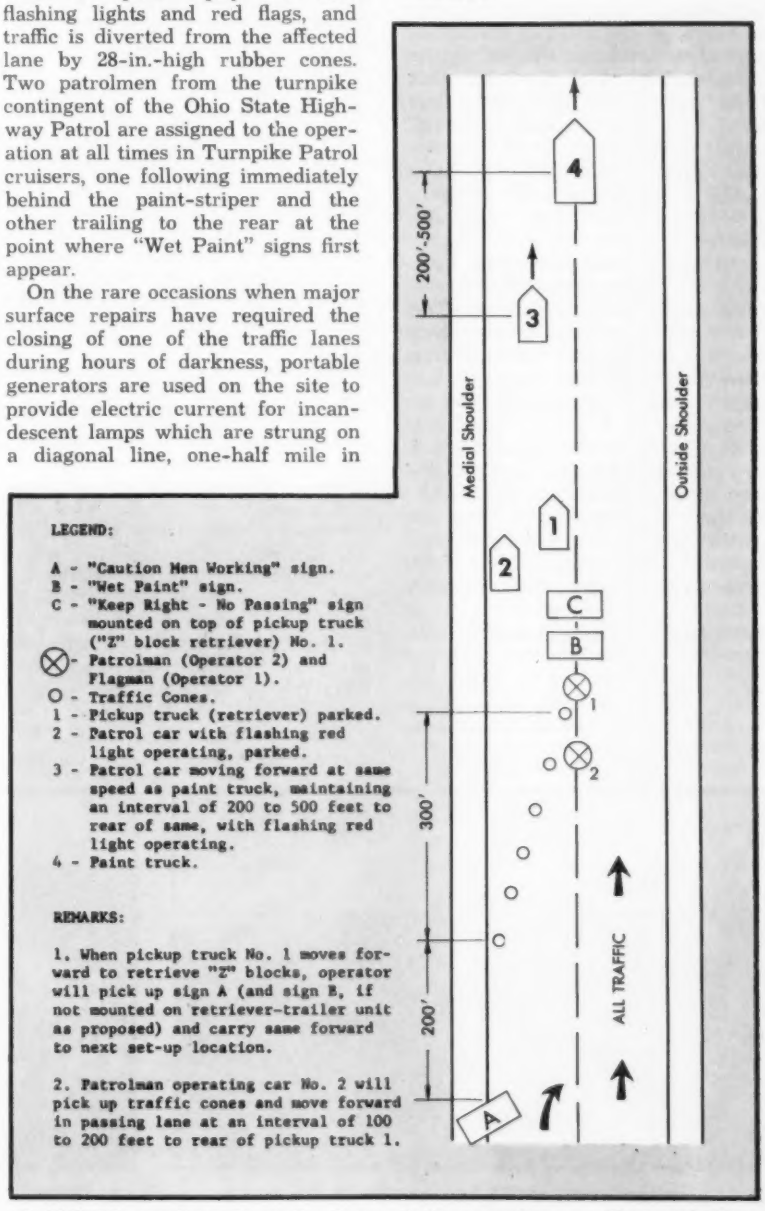
Vehicles employed in snow and ice control operations are equipped with alternate flashing red lights and have red flags on the two rear corners. These vehicles must move in the direction of traffic.

In pavement-marking operations, Ohio Turnpike equipment uses flashing lights and red flags, and traffic is diverted from the affected lane by 28-in.-high rubber cones. Two patrolmen from the turnpike contingent of the Ohio State Highway Patrol are assigned to the operation at all times in Turnpike Patrol cruisers, one following immediately behind the paint-striper and the other trailing to the rear at the point where "Wet Paint" signs first appear.

On the rare occasions when major surface repairs have required the closing of one of the traffic lanes during hours of darkness, portable generators are used on the site to provide electric current for incandescent lamps which are strung on a diagonal line, one-half mile in length, diverting traffic to the proper lane. This type of marking during the hours of darkness has proved to be exceedingly effective.

Maintenance personnel also receive training in fire-fighting, schools being held once a year, with demonstrations of the types of equipment necessary to fight various types of fires. Fire trailers are stationed at all maintenance buildings to assist in protecting vehicles on the turnpike as well as turnpike plant and equipment.

Safety posters supplied by the Ohio Industrial Commission are exhibited at all eight maintenance buildings.


LEGEND:
A - "Caution Men Working" sign.
B - "Wet Paint" sign.
C - "Keep Right - No Passing" sign mounted on top of pickup truck ("Z" block retriever) No. 1.
⊗ - Patrolman (Operator 2) and Flagman (Operator 1).
○ - Traffic Cones.
1 - Pickup truck (retriever) parked.
2 - Patrol car with flashing red light operating, parked.
3 - Patrol car moving forward at same speed as paint truck, maintaining an interval of 200 to 500 feet to rear of same, with flashing red light operating.
4 - Paint truck.
REMARKS:
1. When pickup truck No. 1 moves forward to retrieve "Z" blocks, operator will pick up sign A (and sign B, if not mounted on retriever-trailer unit as proposed) and carry same forward to next set-up location.
2. Patrolman operating car No. 2 will pick up traffic cones and move forward in passing lane at an interval of 100 to 200 feet to rear of pickup truck 1.
Medial Shoulder
Outside Shoulder
200'-500'
300'
200'
ALL TRAFFIC
4
3
2
1
C
B
A

● **SAFETY procedures for traffic lane painting operations are illustrated above.**

ODOR and INSECT CONTROL at an OPEN LANDFILL OPERATION

BART PAINO,
Commissioner of Public Works,
Dobbs Ferry, New York
and
CHRIS E. OLSEN*

THE HOMES of Dobbs Ferry are largely situated on steep slopes which descend rather abruptly to the Hudson river. The shore line is very narrow, and until recently the residents were limited in the recreational opportunities afforded by the Hudson. They had the river but little access to its shore line. Twelve years ago a plan was presented proposing a landfill operation which eventually would give Dobbs Ferry many acres of valuable river front park and play ground.

Originally there was very little room for parking around the railroad station in Dobbs Ferry. The first result of the land-fill operation was the creation of a parking area there for commuters, and this has been enlarged periodically as the need arose.

A river wall of heavy boulders was constructed to enclose some fifteen acres of shallow water. Landfill operations were begun along the portion farthest removed from habitations. To date approximately eight acres of river front park have been created and planted with lawns and trees.

During the early years of the landfill operation we did not receive any complaints about odors or insects. Later, as our operations moved closer to private homes and, finally almost directly beneath a large apartment house complex, we received occasional complaints. No matter how carefully we conducted our operation wind currents and climatic conditions would periodically give rise to justifiable complaints. The continual unloading of refuse trucks was perhaps more to blame than the actual landfill operation. However, since for several years the creation of additional river front acreage will continue to be close to and beneath the windows of our fellow citizens and constituents, we began two years ago to consider ways and means by which future trouble might be prevented. We were not concerned merely about odors but also with insect pests, primarily flies and mosquitoes.

We reviewed available literature and consulted with several sanitary engineers and health department officials. Chemical means seemed best suited for our needs. What we particularly desired was a chemical which would embody effective odor and insect control in one operation. Preferably, it should also be of low toxicity to humans so that it might be handled by our men without extra and costly precautions. Finally, it must be economical enough to meet our limited budget.

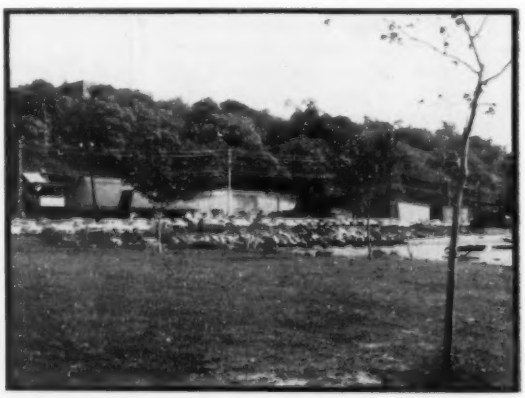
Cloroben was being used by neighboring towns for odor control in sewer lines, lift stations and treatment plants; and it appeared to eliminate roaches and flies in sewers. In June, 1958, we obtained samples and conducted a number of preliminary tests of raw garbage being unloaded and on fill being compacted. These tests indicated that odors could be controlled with a dilution of less than 1 percent. When we tried to observe the effect of this dilution on insect life we found that our refuse insect population was a great deal more complicated than we had suspected. There were seemingly countless varieties. This led to an agreement with the co-author by which he could have all the insects in the Dobbs Ferry landfill in return for which he would determine how much Cloroben the village must apply in order to control or eliminate the insect population. Meanwhile, we concentrated on the odors.

Our landfill procedure follows a standard operation. Refuse collectors unloaded their trucks at the edge of the area being filled. The refuse is thereafter sorted by our attendant who removes large metal objects for disposal to scrap collectors and burns excessive amounts of wood, cardboard and paper. The remaining refuse is spread to a depth of 3 feet, compacted with a tractor to 18 inches and covered by 1 foot of crushed rock and soil.

The landfill operation is four feet above the level of the enclosed lagoon which means that a certain amount of uncovered raw garbage is exposed along the shore line. The water of the lagoon close to the

*Mr. Olsen, formerly with the American Museum of Natural History, is a retired entomologist who was asked for help on this insect problem. After examining the Dobbs Ferry landfill he remarked that he had collected insects in the arctic, temperate zone and the tropics, but never in a garbage dump.

● **TO suppress odors, a 2½-acre portion of the landfill was sprayed with a dilute Cloroben solution, using an old pumper.**



● **COMPLETED landfill section has been converted to commuter parking space and a park with lawns and trees.**

landfill operation is therefore high in sulfides and contributes to the odor problem.

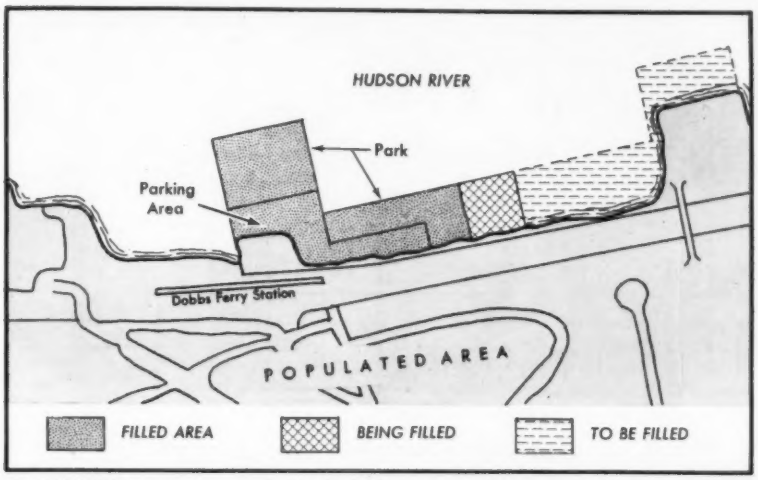
Chemical Application

Our first large scale application of Cloroben took place in July at which time an old fire engine was pressed into service. A 1 percent dilution of Cloroben was made and we sprayed 800 gallons of this over an area of 2½ acres. In compacted areas the application was light; over raw garbage a little heavier; and along the water edge and in the lagoon waters very heavy. In fact, the water along the shore received enough of this dilution to give it a white tinge. The results were remarkable. Odors were suppressed almost on contact. During the afternoon, when spraying was complete, we were unable to detect any objectionable odors even when standing in the center of the landfill area.

No refuse was unloaded in the areas receiving the initial spraying, and we observed it for several weeks to determine the residual effect of the application. The chemical appeared to have some lasting effect and odors now developing came from the unsprayed areas. In late August we made a second application but limited this to the new fill and the shoreline and in September we made a third and similar application. Since the first experimental use of Cloroben we have not received a single odor or insect complaint. Now that we are convinced that this chemical is the answer to our problem we plan to establish a regular routine procedure for the next year. Raw refuse will be sprayed as it is received and spread over the area to be filled. The shore line will receive a separate application every Friday afternoon at the end of the working week. Finally, we plan to treat our refuse collecting trucks periodically with a 1 percent dilution of the chemical.

Reclaiming or creating new land by the use of refuse normally does not involve serious insect problems, for insects breeding in refuse do not travel any great distance. Flies are attracted to those particles in waste which are odoriferous and in a state of decay.

Where ideal landfill operations are possible, that is, when a safe distance from populated areas and of such character that the waste can be compacted and covered promptly, few if any insect problems occur. When this landfill was first examined July 3, 1958, it was obvious that many species of insects were native to the area, and that many others were delivered in the refuse collected in the Village. It was also noted that the insect population was not limited to flies, but included beetles, mosquitoes and roaches.



● **LANDFILL operations in Dobbs Ferry have created approximately eight acres of river front park. Location close to residential areas makes odor control necessary.**

Insect Identification

During July, August and September a number of insect collecting expeditions were made to the landfill and a surprisingly wide range of insects were caught. Some of these were perhaps of interest only to an entomologist, but for the most part, the insects collected belonged to species generally termed pest-flies, mosquitoes and gnats. All were mounted, labeled and dispatched to Cornell University for making a final identification of the collection. It appears that complete surveys of insect species inhabiting refuse disposal areas have largely been neglected by entomologists.

Dr. C. O. Berg, Department of Entomology at Cornell University, reported that the 200 insect specimens from the landfill were unusual in that it included species that he seldom received. Among the fly specimens identified by Dr. Berg were *Musca domestica, Ophira* sp., and *Phaenicia serica*. These are all potential disease carriers. The balance of the insects identified were pest varieties.

Dobbs Ferry, on the other hand, was more concerned with establishing an effective and economical means of chemical control. It was agreed that we would try to determine the insecticidal effectiveness of a landfill and refuse spray using Cloroben. This material had been primarily used for odor control in which field it performed well. Its inhibitory effect on insects and larvae had been noted but the exact dilutions needed to establish a complete kill or satisfactory control were not definitely known. On July 23 the Dobbs Ferry landfill area was examined before and after being sprayed with a 1 percent dilution. It soon developed that it was difficult if not impossible to make exact determinations in the field. The reduction in numbers of insects present was obvious and remarkable but not complete. There also existed the possibility that many were only temporarily affected and might later recover. We might have collected live specimens, confined them and tried various dilutions, but instead decided to create a miniature garbage dump near the home of the co-author at West Nyack. Here within a few weeks we had a natural uninhibited insect population which could be watched and studied in comfort. Various species were isolated, corresponding largely to those collected at Dobbs Ferry. We then made various dilutions of Cloroben ranging from 1 to 5 percent. During August and into September we continued our observations. We arrived at the following conclusions.

A 1 percent dilution applied liberally will establish practical control at a level estimated as an 80 percent reduction. A 5 percent dilution will kill all species of insects. From our observations and studies we have concluded that Cloroben offers interesting possibilities for the control of insects and larvae in waste disposal operations and stagnant waters.

A Metropolitan County Organizes for Storm Drain MAINTENANCE

● TYPICAL flood in a subdivision development after a heavy rain. Lack of proper storm drainage, or of maintenance of existing drains, can be costly to householders.

ROBERT J. HAJZYK,
Chief, Bureau of Operations, Department of Public Works, Baltimore County, Maryland.

HURRICANE DIANE, moving northeasterly at fifteen miles per hour with winds up to one hundred miles per hour, expected to strike the Baltimore area in eight hours. That was the message received from Friendship Airport weather station by our Bureau of Operations on August 16, 1955.

Emergency orders were issued to the highway, water and sewer personnel to be on alert. All equipment necessary to combat the possible effects of the hurricane had to be checked within seven hours. At that time the clean-up from the previous hurricane had not yet been completed, and the men were working desperately to finish their tasks prior to the arrival of Diane.

Hundreds of people had to be moved from their homes during hurricane Connie due to flooding of streams which turned to vicious rivers, destroying everything within reach. Cooperation among all departments of the county prevented loss of life, but nothing could be done to prevent hundreds of thousands of dollars damage to private property, county roads and bridges.

After Diane had passed, the work of cleaning up and repairing the damage was begun again by the forces of the Bureau of Operations. While this work was proceeding, a meeting was called by John B. Funk, Director, Department of Public Works, to discuss means of reducing the damage caused by storms and hurricanes.

Prior to this meeting, the county had no organized storm drain maintenance; work on storm drains was accomplished periodically by men in the sanitary sewer division. It was realized that something had to be

● ENCLOSING and extending a storm drain in Towsonvale. Open drains require excessive maintenance work for removal of trees, bushes, etc., which reduce capacity.

done to prevent the recurrence of storm damage resulting from every heavy rain. Further damage was being caused by the past lack of control over building operations in the flood plains of numerous streams in the county. This deficiency had been rectified in 1951, when the Department of Public Works was given authority to prevent building in the fifty-year flood plain, but the problem still existed for those property owners who had located in the flood plain prior to 1951.

Organization Requirements

Every year ten thousand new homes and approximately thirty-five miles of new roads in Baltimore County add to the amount of storm water discharged to the streams. No maintenance work had ever been done to these open streams; in fact, they had become obstructed by trees, weeds, bushes, sediment, and debris which reduced their capacity. With these facts in mind, we began the task of preparing an organization with equipment to perform necessary work on drainage systems to have them operate at full capacity. This organization had to be of sufficient size, in personnel and equipment, to show results in its first year of operation, but not so large that the cost would reflect unfavorably on the tax rate.

As the county is divided into a Metropolitan area and a Rural area, it was deemed feasible to begin this program in the Metropolitan area. This was divided into nine zones, each having six men: a foreman, a truck driver, and four laborers. The entire program was to be supervised by a Deputy Chief of the Storm Drain Division, under the Bureau of Operations.

● **EQUIPMENT for one storm drain crew: From right to left, a 2½-ton dump truck, a panel truck, an air compressor, sewer cleaning rods, a centrifugal pump and chain saws. In the background is a typical highway maintenance shop. There are 9 crews.**

Each of these zones was to be equipped as follows: one 1-ton panel truck; one 2½-ton dump truck; one centrifugal pump; one diaphragm pump; 500 ft. of fire hose; 500 ft. of steel cleaning rods; 100 ft. of steel tape; and one 36-in. power saw. A central pool of heavier equipment, to be used where the need might arise, was set up as follows: one ¾-yard dragline; one ½-yd. dragline; one tractor backhoe; two Gradall machines; and two No. 933 Traxcavators.

It was evident from the beginning that our hopes of a regular preventive maintenance schedule could not be realized with our existing forces. We were taxed to fullest capacity to handle complaints coming into the office.

It was urgent that the outfall streams for the county enclosed storm drains be dredged to provide adequate waterways. Local public laws gave the county the right to dredge the streams to their original grade line and to remove obstructions which interfered with the flow; and also gave the right of access over private property to perform this work as long as no damage was done to the property. The problem of widening, deepening and realining the streams to carry off the additional water contributed by the new developments upstream presented a problem, since before work could begin, each property owner had to be consulted, advised of our intentions and his permission obtained in writing.

● **DEVELOPERS must contribute, on a sliding scale, per front foot, for enclosing streams within the development and for the installation of needed storm drainage.**

Stream Enclosure

The county has required the enclosure of open streams passing through new developments, and also the installation of needed storm drains within the development. Under the policy set up in the Department of Public Works, each developer must contribute, on a sliding scale: cottage developments at $6 per front foot with a maximum of $350 per lot; group houses at $7.50 per front foot with a maximum of $250 per lot; semi-detached houses at $7.50 per front foot, with a maximum of $300 per lot; acre lot developments pay actual cost; commercial and industrial also pay actual cost. The money is used for the enclosure of the storm drain system within the development, or if not needed in that development, for installation of storm drains in

● **CLEANING existing flow channels, widening, deepening and improving alinement are necessary to permit carrying off additional flow from new developments above.**

other developments or owner-developed areas. Funds are also provided for this program through the issuance of bonds which are incorporated in a two-year capital program which must be approved by the voters through a referendum.

Certain projects which are of such nature as to require a large amount of force-account work and which cannot readily be bid by contractors, are submitted to us for bid. In the event that the Bureau of Operations is low bidder on such work, the contract is given to our forces. At times the county will participate with an individual in the enclosure of an open stream through his property when it is found that the enclosure will reduce damage to the property owner as well as to rights-of-way owned by the county. The percentage of participation is determined by the Director of Public Works and the County Executive. This program has been in effect for approximately four years, and has been accepted by the property owners, at times reluctantly, but at other times willingly. As a result of this program we have, at the present time, organized one crew whose primary function is the completion of these projects upon the award to our bureau.

Progress is being made in eliminating flooding which has occurred along various streams in the county. The program of dredging requires only heavy equipment and a minimum of supervision, allowing the use of other personnel for handling complaints and for doing some preventive maintenance.

This bureau intends to pursue this operation to its fullest extent so that a full-scale maintenance program can be realized, and full protection can be given to all property owners against property damage resulting from storms.

FORMULATING A FINANCIAL PLAN
——*for Local Government*

HARRY L. SEVERSON
Financial Economist and Bond Analyst

THE DEVELOPMENT of a sound financial plan for a dynamic community requires creative and imaginative thinking. The rapid growth and transformation taking place in urban centers is resulting in a considerable amount of discussion of the type of political organization required to cope with the problems of modern living, for the existing political entities are still basically those which were developed in the rural era, now past. In the realm of finance, the readjustments have been particularly slow in emerging. The public has not been willing to admit that a very large amount of additional revenues must be provided through taxes if local governments are to meet, in any reasonable manner, the demands for increased services being made upon them.

Many of the readjustments required by the changed way of life will be disconcerting and certain ones such as heavier taxes will be painful. Those communities which lack leadership and drift with the financial winds will doubtless encounter more jolts in making these transitions than those which prepare for them. There is little hope of a community getting what it needs unless the officials have a reasonably clear idea of the goals toward which they are working. An administration which knows what the community wants can to some extent guide its development during this period of flux, although the period when a change of direction can be made economically may be very short. One of the functions of financial planning, the subject of this article, is the prevention of a financial sprawl which in its own enervating way can be as wasteful as other types of metropolitan sprawl.

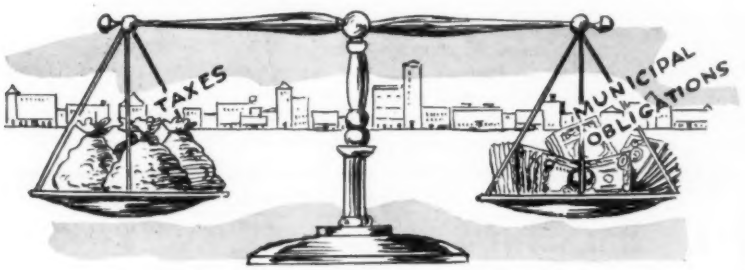
The variation in resources and responsibilities of the many local governments even within the same metropolitan area are such that no standard pattern of finance can be successfully imposed on a group of local units. In developing a financial plan recognition must be given to the illogical structure of local governments. Even though boundary lines between jurisdictions may be the result of political accidents of the past and, therefore, do not delineate economic units, they are very important when financial capacity is being considered since it is the political unit, not the economic unit, upon which taxes are levied. Moreover, a great deal of local pride has grown up around many of these political units and attempts to create a more logical organization often run into serious opposition.

The costs of each projected capital improvement (as well as the other demands for funds), and the available methods of financing should be considered at all stages of the plan-

ning process, but the definite formulation of the financial plan becomes one of the later steps. The amount of funds which will be required, and the timetable, will be developed from the capital facilities survey and the capital budget. The gap between "needs" and "means" which is so frequently encountered will presumably have been resolved at an earlier stage. The problem at this point is how to marshall efficiently, over a stated period of time, the available financial resources to meet the expanding needs of the community.

The Major Policy Decisions

The preparation of the financial plan involves a number of major policy decisions. This typically involves many compromises, not only



because the goals are not entirely compatible, but also because of the conflicts of interest, real or fancied between various groups and geographical areas. Unfortunately these conflicts often generate colorful oratory and emotional outbursts, which attract a great deal of attention. This tends to obscure the obvious fact that almost everyone has an interest in promoting a thriving harmonious community. It is this common interest that astute public officials highlight when attempting to work out the major compromises.

With the important exception of highways, a large proportion of the cost of capital improvements made by state and local governments has been financed traditionally by borrowing. In some instances, the law requires that the entire cost of capital improvements be met in this manner. In the short run this is usually the easiest method of finance —aside, of course, from getting a grant from another Government. A presumption has come to prevail that all or at least most of the cost of capital improvements should be financed by borrowing. This is unfortunate because a strong case can be made for paying for a part of the cost of each project on a pay-as-you-go-basis. The strongest argument in favor of this is economy. The principal upon which interest must be paid is reduced and since credit quality is improved the rate is also likely to be lower. Another very important advantage of a pay-as-you-go policy, when combined with rather rapid amortization of the principal, is that volume of debt is held down thereby conserving credit for genuine emergencies. The cities which entered this period of rapid growth with their existing capital improvements largely paid for are in a much better position to finance new projects than those which had a large debt.

Debt service is not pleasant to contemplate, but with the great increase of debt it will inevitably become a larger item in the budget of most local governments.

The plans for raising the additional revenue required to service an expanding debt structure should be made when the proposed capital facilities are under contemplation. It is easier to get an authorization to levy more taxes while public enthusiasm over the new improvements is running high than it will be later. After the projects have been completed they are quickly taken as a matter of course. The inconveniences which lead to their construction are soon forgotten, but any increases in taxes hurt most when they are imposed. Also by levying the additional taxes at the time the improvements are authorized some funds accumulate for at least a token pay-as-you-go. Furthermore, the coupling of the tax-levy and the authorization of the improvement tempers the demands on the part of the public for additional capital improvements. Public officials are likely to find that problems of balancing the budget are somewhat reduced by keeping a separate price tag on each large project.

The problems of providing additional funds for debt service are complicated by the fact that the new capital facilities must be operated and all of the other costs of government are also rising. The demands for additional services tend to develop even more rapidly than the community grows while revenues expand very slowly—except as definite steps are taken to increase them. Outmoded restrictions often make the task of raising more revenue difficult.

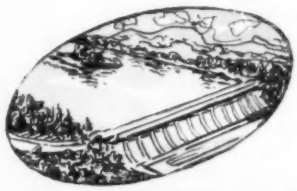
Tax ceilings may make it difficult to raise more revenues from the taxes upon which such ceilings are imposed. Exemptions, such as the homestead exemption, may also reduce the yield of certain taxes while in other instances tax payer resistance to higher levies limits the feasibility of obtaining more revenue from a particular tax. Consequently the search for new and less obvious forms of taxes goes on continuously along with pressures upon other governments for grants-in-aid. There is a rather pronounced tendency to impose user taxes wherever feasible. Familiar examples of this are water bills, to which a charge for sewage disposal may be attached, parking fees, and tolls for the use of bridges and highways.

Local officials are caught in the middle. On one side pressures are heavy to keep taxes from rising much above those in adjoining communities, while on the other pressures are likely to be equally strong to provide a level of services at least as high as the neighbors enjoy. A community which makes a poor showing on either count is likely to be adversely affected in the competition with its neighbors for new factories, commercial developments and residential housing. Once a wave of growth has passed over an area a pocket of retrogression may develop, after which it becomes difficult to attract private developments.

The task of raising additional revenues is so great that expanding communities, from necessity, are likely to use a combination of all methods. In practice, expediency may play an important role. When there is a tendency to make each decision regarding additional revenues independently the tax system as a whole may take on a weird shape. It is, therefore, necessary to review the revenue system in its entirety to ascertain its adequacy, its vulnerability to a depression and its flexibility. This is the proper place to emphasize the embarrassment which may result from inability to fill the gap due to declining revenues in a depression. Prospective investors in the bonds of the unit are always favorably impressed by a reserve of unused taxing power for emergencies.

(*Continued on page* 144)

LAND USES AND WATER CONSUMPTION REQUIREMENTS



An abstract and condensation of a thesis submitted to the Faculty of the University of North Carolina in partial fulfillment of the requirements for the degree of Master of Regional Planning by Rodolfo Silva, San Jose, Costa Rica.

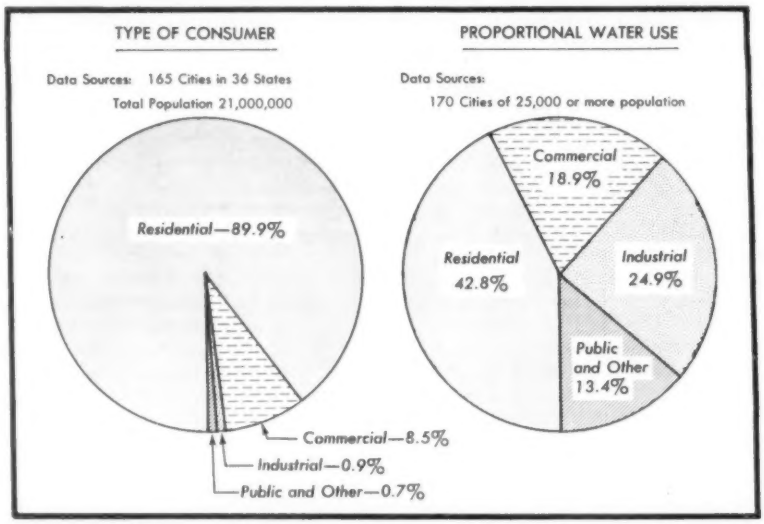
INFORMATION valuable in the design of water works can be gained from an understanding of the effect that land uses have on water demands. The extent of future expansion for each land use, the intensity of development and the direction and limits of growth influence water use. So do recent trends in domestic consumption. Both are important and must be considered in determining the adequacy of any water system to meet future growth.

A land development plan provides information on the amount of land that will be devoted to each purpose and how intensively it will be utilized through gradual development. From knowledge of how much water each individual use requires, the total consumed in the area can be computed. Peak water demands are the bases for designing certain distribution facilities, but for proper design it is necessary to know where maximum users are located and how much water each is likely to use.

Though the characteristics of different cities are far from uniform, a selected sample[1] of 165 communities in 36 states, with a combined population of 21,354,000, classifies water system customers according to land use as 89.9 percent residential consumers, 8.5 percent commercial, 0.9 percent industrial and 0.7 percent public facility. Another survey[3] of 170 cities with populations of 25,000 or more, showed domestic or residential consumption as 42.8 percent of the total, commercial with 18.9 percent, industrial with 24.9 percent and public and other with 13.4 percent. Consumption figures, classified according to land use also, will vary greatly with local conditions.

Average Residential Use

Per capita water consumption for all classifications of customers has increased from about 90 gallons per day in 1900 to 127 gallons in 1940, 149 gallons in 1954 and 155 gallons in 1955, according to a number of studies.[2, 3, 4] Three factors dominate in affecting the steady increase in that portion attributed to residential consumption: Modern technological advances in water-using home appliances; higher incomes and better standards of living; and the trend toward suburban living.



● **NUMERICALLY, residential consumers far outweigh all other types, though they represent less than half of total water consumption. Data from references 1 and 3.**

The average rate of water use for an automatic washing machine is 3 to 7 gpm, with a total volume of 36 to 50 gallons used per washing cycle.[5] The number of times it is used during the week varies from once a week for small families to every-day use in homes where there are small children. If the washing machine is operated 5 times a week, the amount of water required would be from 180 to 250 gallons per family per week, or about 6.5 to 9 gpcd. The automatic dishwasher uses water at a rate of 2.5 to 5 gpm, requiring from 4 to 8 gallons per load.[5] The use of an average 7-gallon-per-load dishwasher 3 times a day would demand 21 gallons of water daily, or about 6 gpcd. The garbage disposal unit demands from 1.5 to 2.5 gpm,[5] and it is estimated that it needs from 3 to 4 gpcd to be operated.[6]

The lawn sprinkler system and the air conditioner have increased not only the average water use, but the peak residential loads. Although the lawn sprinkler cannot be strictly considered a new element in the water-use picture, underground lawn-sprinkling systems were not used extensively until recently, when the advent of plastic pipe made them much cheaper and within reach of most medium income families. For a medium size lot (60 x 100 feet) with a 3,000-sq. ft. lawn, about 1850 gallons per week or 75 gpcd would be required to water it, assuming that one inch of water per week will be adequate for the

proper maintenance of the lawn. In Great Neck, New York, it was determined that the average lawn sprinkling system created a demand of over 70 gpm, equal to the average rate required to supply a normal residential population of 700 or more.[7]

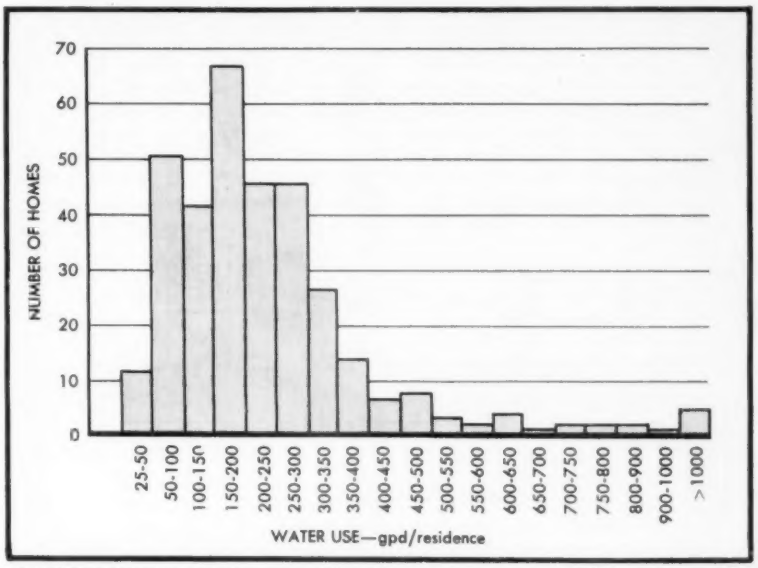
Air conditioning has had a substantial effect on the use of water. Water-cooled units for residential use range in size from 3 to 10-ton capacity, requiring about 1.5 to 2 gpm per ton. This imposes a water demand of 6 to 20 gpm, as water conserving services are not generally economical in these sizes.[5] If a 3-ton air conditioner installed in a home is assumed to operate an average of 8 hours a day without water conservation during the summer at a rate of 2 gpm per ton, the total water required would be 86,400 gallons per month, or about 825 gpcd. This is about 15 times the average winter consumption for the same home.[8]

Higher incomes have allowed families to provide for more complete sanitary facilities in their homes and to buy a number of the modern appliances mentioned above. Multiple bathroom facilities and even individual swimming pools are now often found in residential neighborhoods.

Finally, the trend toward more spacious living in the suburbs has also had an important part in increasing residential water use. The movement of population to the suburbs has been spectacular during the past decade. Of a gain of 11.8 millions in civilian population in the United States from 1950 to 1955, almost 98 percent took place in metropolitan areas. The growth rate of the suburbs was seven times that of central cities. Suburban areas showed an increase of 27.8 percent during the period, while central cities increased by only 3.8 percent.[9] The result of these trends, for which the increased use of the automobile is largely responsible, has been to contribute to rising residential water use. Suburban homes have been built on larger lots, with more expansive lawns, and the preservation of the grass and plantings has required the use of large quantities of water, particularly during the hot dry summers.[10]

Maximum Day Demands

The average water consumption has increased considerably in the last decades. However, the rate of growth of peak demands has been even more pronounced, and a growing spread between the maximum and average demand can be observed in most communities. The maximum and average pumpage for Chicago, Illinois, from 1920 to 1953, shows that the ratio of maximum-to-average day has increased almost 1 percent per year for the last 10 years, while the ratio of maximum-to-average hour has increased at a pace of about 1½ percent yearly.[11] These increased ratios are believed to be caused by the previously mentioned factors: air conditioning, lawns, and the numerous automatic household devices. These have decreased the diversity factor for home water use.



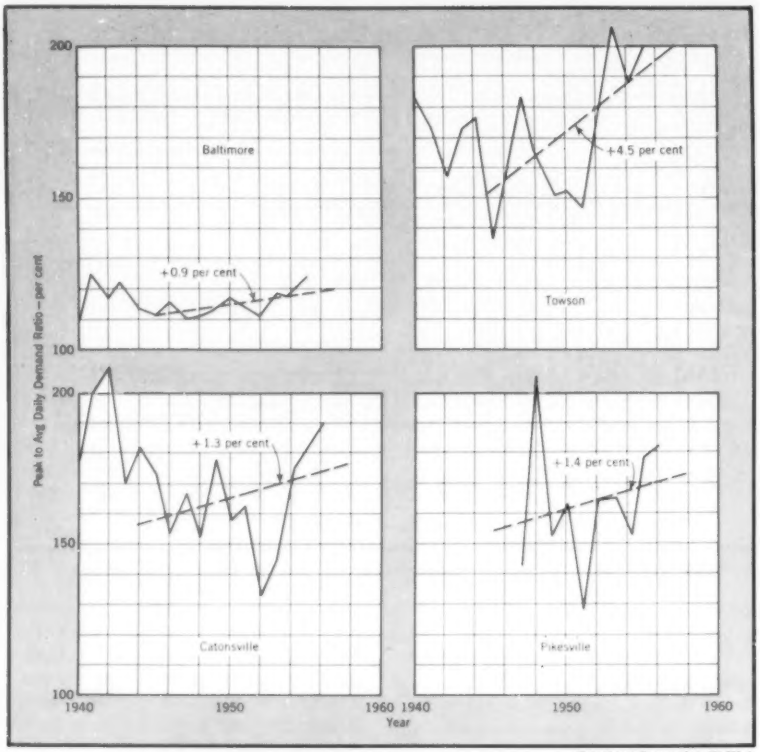
● **FREQUENCY distribution of residential water use, as reported in reference 33.**

Surveys of water use in Milwaukee, Wisconsin, also show that peak demands are increasing at a faster rate than the yearly average. While the population supplied with water increased 50 percent, the yearly average use rose 100 percent, and the unrestricted peak use increased 250 percent.[14] In the city of Baltimore,[4] the rate of increase of the ratio of peak to average day use was 0.9 percent per year; and for three residential areas in Baltimore County it was from 1.3 to 4.3 percent per year. The ratio of maximum to average day has increased since 1946 from 156 to 200 percent in Towson; from 154 to 190 percent in Catonsville; and from 141 percent in 1947 to 182 percent in Pikesville. In two New York state residential areas, the increase was 5.8 percent per year in one for the 1945-1955 period and 2.3 percent per year in the other in the 1948-1953 period.[13] In Milwaukee,[14] the peak day demand from a residential suburb was 300 percent of the average; from an industrial suburb 200 to 250 percent; and from the entire system 165 percent. In Kansas City,[15] the average for the entire system was 178 percent. Both Milwaukee and Kansas City reports refer to about 1953.

A study of maximum day demands in residential areas of 70 communities in 11 Middle Atlantic States for the period, 1940 to 1955, by Wolff[4] indicated that for cities with populations less than 10,000, the percentage ratio increase is more than 4 percent a year; in the 10,000 to 25,000 population group, the increase is 2 percent a year; for 100,000 to 250,000 population the increase is 1.6 percent per year; and for cities above 250,000 it is 1 percent. The study also showed that many areas varied from the norms indicated and the results should be considered a guide and not a definite answer.

There are seasonal variations also, more marked than those reported in older textbooks. A study in Kansas City, Mo.,[12] showed September to be the month of maximum usage. The single family group using more than 25,000 gals. per month showed the maximum month to be 2.75 times the average, while other groups ranged from 1.28 to 1.55 times the average. Figures from other areas show essentially the same fluctuations though with variations as to the month reported to be maximum. Resort cities, as would be expected, are likely to be especially variable.

In many residential communities peak hourly rates have been found to exceed the combined effect of fire



Courtesy Journal A.W.W.A.

● **RATIO of peak to average daily demand is much higher, fluctuates more and is increasing more rapidly in the suburbs than in the center of a metropolitan area.[4]**

flow plus maximum daily consumption rate, therefore becoming the determinant factor in the design of the distribution system.

Maximum Hour Demands

In some new communities, as well as in suburban residential areas of large cities, it is not unusual for the peak hourly demand to exceed six times the average daily rate.[16] In a Michigan town, a maximum hour of 15 times the average rate was determined.[17] Tests conducted in residential neighborhoods in Baltimore[4] measured peak hourly flows ranging from 6 to as high as 20 times the average daily use, depending on the type and age of the neighborhoods. In Albuquerque,[18] peak hour demands of 2,000 gpcd (7 times the average) have been reported in some newly built residential areas.

Peak hour demands generally take place twice a day in residential communities. The first peak occurs in the morning, originating from water used for bathing and breakfast preparation. The second takes place late in the afternoon or early in the evening, and is due to dishwashing and lawn sprinkling.

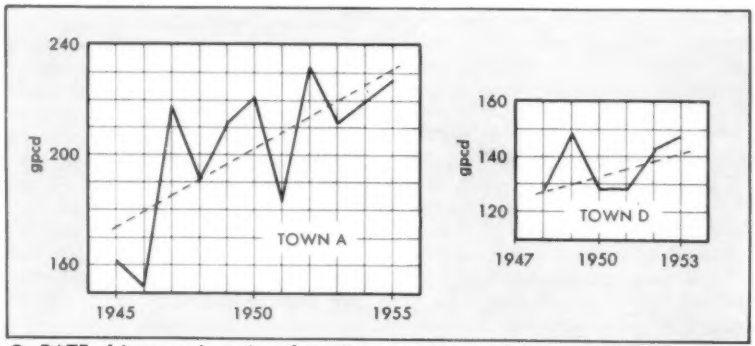
Maximum hour demands vary from one community to another, according to climatic conditions, age and density of the neighborhoods, amount of lawn sprinkling and air conditioning, and other factors already mentioned. The increase in maximum hour demands has become a very serious problem for many communities which have been forced to impose restrictions on the use of water for lawn sprinkling and air conditioning through ordinances, surcharges and other measures.

Instantaneous Demands

In a California study,[19] maximum instantaneous rates for residential areas were found to range from 6 gpm (about 2200 gpcd) for small home sites without yard sprinkler systems, to more than 70 gpm (about 25,000 gpcd) for larger home sites with yard sprinkler systems throughout the entire exterior. It was determined that in the typical California subdivision, with lot sizes ranging between 5,000 and 10,000 sq. ft., the maximum demand per customer was 26 to 44 gpm or about 9,000 to 16,000 gpcd. Assuming that approximately 40 percent of all customers will exert this demand simultaneously, the investigator concluded that an average of 10 to 18 gpm (3600 to 6500 gpcd) could be considered as typical of peak demands in California's first class residential areas.

The analysis also derived standards for areas of more rural character with predominantly small homes, establishing that peak demands range from 6 to 10 gpm per customer (about 2200 to 3600 gpcd). Considering again a factor for simultaneous water use by a number of customers, it was concluded that an average of 4 to 6 gpm (1400 to 2200 gpcd) was adequate as a criterion for designing distribution systems in these areas.

At present, lawn sprinkling systems are probably responsible for the highest instantaneous demands to be found in residential areas. Considering the Great Neck, New York,[7] average lawn sprinkling system demand of over 70 gpm and that there are now more than 400 sprinkling systems in use in the community, a potential water demand of more than 28,000 gpm is created by less than 5 percent of the population. Even assuming a diversity factor of 20 to 40 percent to introduce a correction for simultaneous use, there would still be a demand of 5,600 to 11,200 gpm originated by only a small segment of the population.



● **RATE of increase in ratios of maximum to average daily per capita consumption varies. Both A and B are residential towns with populations of 16,300 and 43,500.[13]**

The total consumption for irrigation may not be more than 10 percent of the average annual use.[20] In Milwaukee, only 2 percent of the total revenue from water sales comes from water used for lawn sprinkling. Yet 50 percent of the system capacity is required for this use during peak days.[14] Therefore, the problem created by lawn sprinkling does not greatly concern average use of water, but it does affect peak demands during dry, hot summer days.

It must be pointed out that the actual maximum sprinkling demand is not as great as it could be due to its relatively high diversity factor. A recent study made in Baltimore estimates that 20 to 40 percent of the residential areas use lawn sprinklers during the peak hour.[4] In Columbia, South Carolina, the lawn sprinkling diversity factor is estimated at 15 percent,[21] and Weir has assumed it as 10 to 15 percent for St. Louis County, Missouri.[22]

Air Conditioning

The typical unit for residential use ranges from 1½ to 5-ton capacity for air-cooled units, and from 3 to 7½-ton capacity for water-cooled units,[23] but only the latter affects water consumption. The most popular residential sizes are the 3-ton and the 5-ton units, which according to surveys made in Trenton, Missouri, have average monthly water uses of 3,500 cu. ft. (about 220 gpcd) and 4,600 cu. ft. (about 285 gpcd) respectively.[24] These figures apparently represent yearly averages, since water consumption for these same types of units during summer months has been found to be much higher in other cities.

A study was made in St. Louis County, Missouri, during 1954 to determine the influence of air conditioning on peak water demands. It was found that residences with air conditioning had a summer water use varying from 5½ to 7 times their non-summer consumption. The ratio was less than 1½ to 1 for houses without air conditioning.[22]

In Kansas City[8] a study of the air-conditioning problem determined that the average 3-ton residential unit operates about 1000 hours during the summer months with a demand of 1.5 to 2 gpm of water per ton of capacity. Considering this demand spread over a 4-month period, it means operating an average of 8 hours a day. On this basis, the per capita consumption of a 3-ton unit demanding 2 gpm/ton in a residence with 4 persons will be 2 gpm times 3 tons times 60 min. times 8 hrs/4 persons = 720 gpcd, which is only slightly higher than the results obtained for St. Louis.

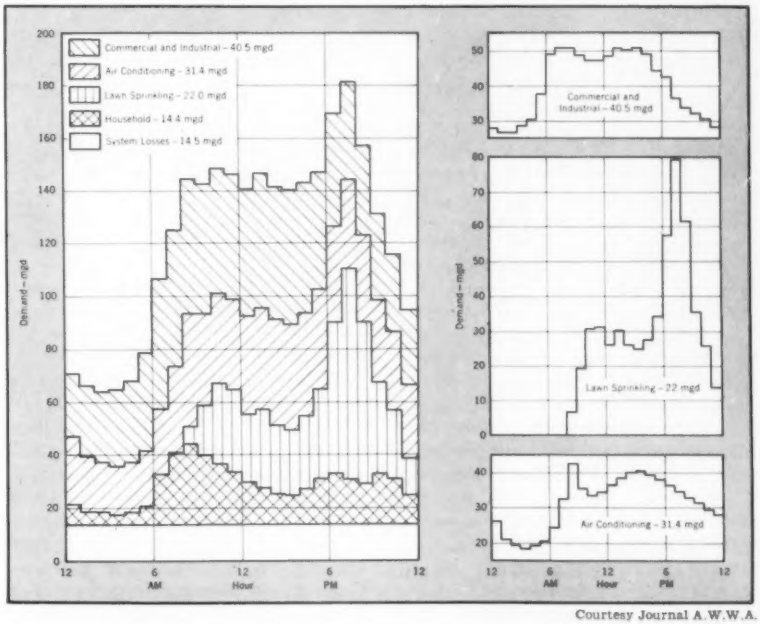
The air conditioning water use load has the same general characteristics as the lawn sprinkling load; it has a seasonal character and its principal effect is on peak demands rather than average yearly water consumption. However, the diversity factor for air conditioning is much lower than for lawn sprinkling. While from 10 to 15 percent of the residential customers are sprinkling on the peak hour, at least 95 percent of all air conditioning units will operate for maximum periods during all hot days.[22] It has been estimated that if homes only were completely air conditioned (non-conserved units), peak production facilities would have to be increased 10 to 12 times their current capacities.[25] This situation, however, is not likely to appear, due to present trends toward more air-cooled and fewer water-cooled units in homes, and to the imposition of restrictions on water use for air conditioning.[8]

Other Factors

Local conditions affect general water use. Consumption varies according to geographical location; water pressure; water cost; metering; climate, including rainfall and its spacing, which affects lawn sprinkling; the size of the community; family income; residential densities; property values; and business activity. The business activity approach was used in California in trying to relate per capita consumption to economic factors in the community. After failing to find a correlation between yearly variations in water use and climatic conditions of rainfall and the temperature for the city of Los Angeles, economic indicators were considered in seeking a valid explanation of the reduction in consumption during the depression years.[26] The "business activity index" was taken as the best available measure of the depression effects. This index is a weighted average of ten seasonally adjusted business series, the respective percentage weights being: department store sales, 15; building permits, 5; Los Angeles bank debits, 20; residential city bank debits, 5; agricultural city bank debits, 5; industrial employment, 20; industrial power sales, 13; railroad freight volume, 6; telephones in use, 7; and real estate sales activity, 4.

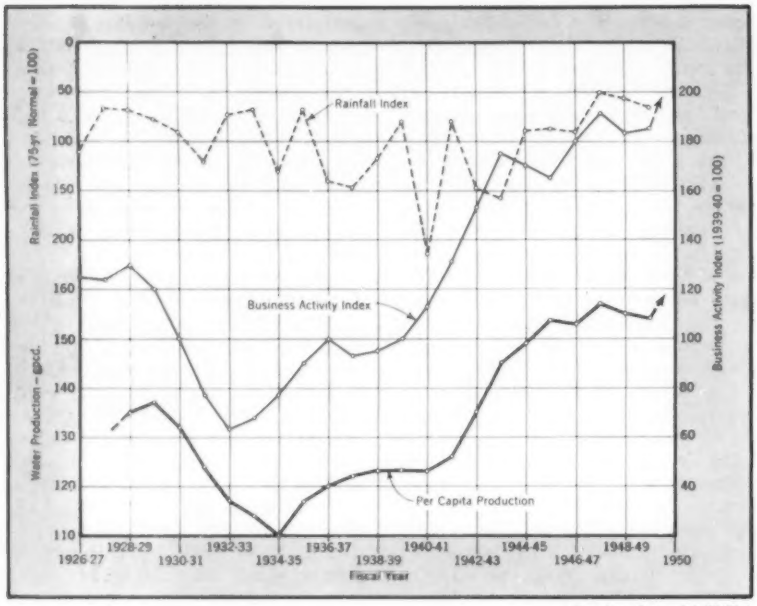
When average per capita water use and the business activity index were plotted together, a very high degree of correlation was found between these two variables. It was also noticeable that the rainfall curve bore little relationship to the water use curve.

It was concluded in this study that "the business activity represented by the index is evidently the dominant significant factor affecting regional per capita water use."[26] The direct relationship between the



Courtesy Journal A.W.W.A.

● **BREAKDOWN of total consumption for the maximum day in Kansas City, Missouri, 1954. Graph at the left shows additive efects; at the right, respective components.**[34]



Courtesy Journal A.W.W.A.

● **CORRELATION between the business activity index and the per capita water use in Los Angeles indicates that business activity is the dominant significant factor.**[26]

variables was determined by the equation $W = 0.365\ I + 87$, where "W" represents per capita water domestic and industrial use and "I" the business activity index.

Commercial Water Use

Commercial consumption includes all the water used in stores, office buildings, restaurants, hotels, garages, and other places of business service. According to the USPHS survey of water use in 1954 for communities of 25,000 population and over, commercial consumption was estimated to account for nearly 19 percent of the total municipal water use, or 28 out of the 149 gpcd reported as the national average for that year.[3] A statistical analysis of water works data for 1950 also showed that the revenue from commercial water sales represents about 20 percent of the total sales, compared with 53 percent for residential sales,[27] which seems to coincide with the USPHS findings after adjusting for differential rates in commercial and residential water use.

Commercial water use has been commonly expressed in gallons per day per service, but reservations exist in the use of this unit because of the great variability in size of different services. Perhaps a more significant way of measuring commercial consumption would be a determination of the amount of water per unit area (floor space) required by various types of commercial establishments, but standards derived on this basis are incomplete. The use of standards of this type would allow a more expedient application of planning techniques, which normally estimate commercial use requirements on a floor area basis. Symons proposes that a standard of 300 gpd per 1000 sq. ft. of floor area would be adequate to use as an average for commercial establishments.[2]

The trend towards increased installation of air conditioning units in commercial establishments has had a definite effect in increasing the average use of water as well as the peak demands. In Milwaukee it is estimated that 43.5 percent of the average daily use was required by air conditioning in 1956.[20] In Chicago, the rate of usage for this purpose reached 18.7 percent of the average day demand in 1954.[20] The amount of air conditioning use in these two cities, according to recent estimates, is 60 tons per 1,000 population for Milwaukee, and 70 for Chicago. From 85 to 90 percent of these air conditioning units have no provision for water conservation.

Kansas City probably has the highest relative amount of air conditioning among large cities in the country, with 140 tons per 1,000 population. However, an ordinance prohibiting the installation of units without recirculation and the application of demand charge rates have reduced the amount of non-conserved air conditioning to only 12 percent of the total.[20] The water demand exerted by non-conserved equipment still accounted in 1954 for 23 percent of the overall system maximum day demand, and for 7.3 percent of the annual water usage.[8]

The air conditioning load has developed mostly during the last 10 years. Although the rate of increase has not been uniform for all regions of the country and some cities have not been seriously affected as yet, the main concern in regard to water supply systems is that with the present trend of rapid growth, there is a consequent potentiality for excessive demands if this increase is permitted to continue unchecked.[20]

The greatest water demand required by air conditioning comes from non-conserved units, though equipment providing for conservation also requires a considerable amount of water. The non-conserved type of unit uses water at a rate of 1.5 to 2 gpm per ton of air conditioning, while that using recirculation require only from 0.05 to 0.15 gpm per ton, which amounts to a reduction of about 90 to 95 percent.[23]

On the average, water requirements during the maximum day will be 1150 gpd per ton of non-conserved air conditioning against 57 gpd per ton for the conserved type of unit,[15] assuming a maximum usage of about 10 hours a day. Of course, this figure will vary with the temperature conditions. Mathews found for Kansas City that in a 122-day season, approximately 8.1 million gallons were used per 1,000 tons of non-conserved equipment for each 1000 degree-hours above 80° F.[15] This is equivalent to an average water use of about 75,000 gal. per ton per season (615 gpd per ton), which represents 5 to 6 hours a day of air conditioning service.

The number of hours of operation for air conditioning equipment varies again with the weather conditions. In the Chicago region, it is estimated that air conditioning is generally operated approximately 1,000 hours a year,[23] which represents about 8 hours a day on the basis of a four-month season.

Another study of air conditioning made for Trenton, Missouri,[24] suggests that an average of 800 cu. ft. (6,000 gal.) per month per ton of cooling capacity is adequate for estimating total water use in commercial districts.

It should be noted that this standard was derived for a city of only 6,500 population, and possibly it could be applied to other similar towns. In the case of a

(Continued on page 200)

DOUBLE SEAL COAT——— FOR PRIMARY and SECONDARY ROADS

DONALD D. CHAMBERLIN,

Assistant Public Works Director, Maintenance Division, Contra Costa County, Martinez, California

A DOUBLE seal coat for 12¼ cents a square yard! Contra Costa County has just completed over 100 miles of double seal coating at this low rate. This seal coat program is one of the major annual programs carried out by the Maintenance Division of the Public Works Department using its own forces and equipment. With 1,041 miles of County roads we have found the seal coat program to be one of our most valuable and beneficial maintenance procedures.

Prior to 1940, Contra Costa County was a community of 100,000, lying on the eastern shores of San Francisco Bay, with primarily an agricultural economy. World War II saw a rapid increase of population due to wartime activities in all parts of the County but mainly because of shipyard activities in Western Contra Costa County. Being adjacent to the industrial and commercial centers in Oakland and San Francisco, Contra Costa County naturally served as a residential community during World War II and during the early post war years. The economic pattern through the war and to the present has been one of change from an agrarian through the typical suburban sprawl trend and then on toward a manufacturing economy.

Road problems have increased in about the same manner as has the population which today stands at almost 375,000; an increase of nearly 375 percent from 1940.

Maintaining a road system of this size has required a fairly elaborate and comprehensive repair program. Several years ago the County embarked on a seal coat program resulting today in a road system of hard-surfaced, all weather highways providing smooth, convenient transportation for the people of the County at a minimum cost.

We have found on our farm-to-market type of road, usually constructed many years ago with base and drainage features inadequate for today's traffic, that a double seal coat provides the cheapest and best maintenance. The double seal provides a small amount of additional strength, it discourages entrance of water into base material of low "R" value and it helps keep an integral surface, thereby reducing routine patching operations. A double seal coat on this type of road has a service life of from 4 to 7 or 8 years and during its life requires very little maintenance.

● **CHIP SPREADER which is self-propelled is the nucleus of the seal coat train. It follows immediately behind the distributors which apply asphalt at 130 degrees F.**

● **THREE rollers follow immediately behind the chip spreader. First is a pneumatic-tired roller. Following this, two passes are made with 5 to 8-ton steel wheel rollers.**

● **SEAL COAT train in operation. First comes the distributor; this is followed by the spreader and the rollers. Season average was 2.02 miles per day completed.**

This seal coat, then, is provided at an annual cost of $200 to $400 a mile—a fraction of our average annual cost of $1,000 to $1,200 a mile for all maintenance on all County roads.

On the primary road system the double seal coat rejuvenates old pavements deteriorating due to age, delineates the traveled way and provides a good non-skid surface. We also use the double seal coat on residential streets where we find the same problems as on a primary road and where appearance is important.

In other situations where the Public Works Department finds funds are insufficient to rebuild or resurface highways with plant-mix materials, we use the double seal coat as a substitute with satisfactory results. In fact, we find few limitations in the use of the seal coat program.

Equipment

The Maintenance Division performs all work. Three years ago the County purchased a Flaherty self-propelled chip spreader. This forms the nucleus of the seal coat train. Two 1000-gallon oil distributors, equipped with Jones spreader bars and working from a truck and trailer oil tanker unit apply the oil. The chip spreader follows immediately behind the distributors. Three rollers follow the chip spreader. In open country we have sustained a rate of application of 3½ miles per day and our season average is 2.02 miles. The asphalt used is a penetration type emulsion conforming to the requirements of Section 56 of the California Division of Highways Standard Specifications. This asphalt is delivered at a temperature of 130° F which contributes to the uniformity of the oil spray operation.

The mineral aggregate is hauled from stockpile sites, or depending on the location, directly from the quarry to the chip spreader in 10-yard dump trucks. These trucks are rented, and the number will fluctuate from 5 to 8 during the topping season. We use a pneumatic tired roller immediately behind the spreader and follow this with at least two passes using 5-8 ton rollers. Traffic is controlled as necessary with light traffic only permitted on the first course. All materials meet the Standard Specifications of the State of California, and tests are taken at frequent intervals to insure compliance.

We are completely sold on the double seal. This program results in immediately providing good public relations through resurfacing many miles of roads each year and, over the long term, provides a better road system at a lower maintenance cost. Details of our costs are shown in Table 1.

Table 1—Costs for Double Seal Coat Treatment

Year	Miles Topped	Total Cost	Cost per Mile	Cost per Sq. Yd.	Gallons of Oil Sq. Yd.	Tons of Rock Sq. Yd.
1958	109.2	$169,963.90	$1,556.44	$0.1225	0.3609	0.0165
1957	111.35	184,152.08	1,651.17	0.1322	0.4257	0.0166
1956	133.5	205,354.75	1,538.24	0.1259	0.4135	0.0164

CONCRETE SAWS AID HIGHWAY PROGRAM

ON A $1,451,863 project near Forsyth, Ga., in Monroe County, the first portion of Georgia's 1100-mile share of the Federal multi-billion dollar Interstate Highway program, Clipper concrete saws and reinforced abrasive blades are being used to saw the transverse and longitudinal control joints. In some cases this is done just slightly more than two hours after the cement is placed. Other Georgia Interstate projects currently in progress using Clipper saws and blades include a by-pass near Tifton and 20 miles of highway 85 near Atlanta.

NEATNESS COUNTS ON SEWER CONSTRUCTION PROJECT

KEEPING OFF private lawns can be a problem during the placement of sanitary sewers. It's not, however, in the City of St. Louis Park, Minnesota (population 41,000) where an effective method of excavation and clean-up was used to hold operations within the confines of residential streets.

Phelps-Drake Co. Inc., Minneapolis, Minnesota, contractors, have the $986,000 contract for laying 120,000 lineal feet of pipe. The project, officially designated Lateral Sanitary Sewer Project 58-3 was let April 9 and completed in December, 1958.

The major part of the job called for laying 63,000 feet of 8 inch vitrified clay pipe, although some larger diameters were used. The average depth of excavation runs about nine feet with a maximum depth of 21 feet. Manholes were placed at 300-foot intervals.

Only a width of about 18 feet could be used by the pipelaying crew without damaging lawns on each side of the street. To solve this problem, Phelps-Drake used a Lima Model 44 dragline with 1¼-yd. bucket to remove succeeding 24-foot sections of the excavation to the desired depth. The bituminous material from the street and underlying rock and gravel are backcasted in front of the cut. The six man pipe crew then place the pipe by hand and do the initial covering. Pipe is laid under the center of the street.

A Caterpillar No. 977 Traxcavator with side dumping bucket pushes material into the hole and loads excess excavation into six yard tandem dump trucks. The No. 977 also cleans up around the completed fill. Since it is not necessary for the Traxcavator to turn in order to dump into the trucks, the street's close quarters posed no difficulty during the loading operation.

Unless hampered by bad weather, 175 to 200 feet of pipe could be laid during a nine hour day. A five day work week was normally scheduled. Gas lines were located, capped off and hooked up afterward by the gas company. Phelps-Drake had the responsibility for disconnecting and reconnecting water lines.

R. O. Folland, Director of Public Works for the City of St. Louis Park, was in charge of the Northside Sewer Project. Vernon Morgan was Phelps-Drake's project superintendent. G. M. Orr Engineering Co. were the consulting engineers for the City of St. Louis Park.

Courtesy Caterpillar Tractor Co.

● **BECAUSE pipe was laid in the center of the street, it was necessary to clean up promptly to permit full use of streets for traffic. Trenching was by backhoe.**

● **TRACTOR-mounted loader with side dump was used to backfill the trench, to clean up and to load excess spoil. Cuts ranged to 21 ft. deep and averaged 9 feet.**

LITTER ON COUNTY HIGHWAYS

Is a Costly Problem

ON THE 1958 County Engineers' questionnaire sent to county engineers and officials, questions were asked about their litter problems, how it is collected, and what type of program is used to educate the public not to litter the highways.

A total of 457 replies were received on these questions as follows: 408 counties said they had a litter problem; 268 use hand labor and trucks in their pick-up; 5 have sweepers; 7 set out receptacles; 2 place litter bags and 5 use barrels; 74 counties have a sign program; 56 use some type of publicity program; 29 counties have sheriff patrols and fine the offenders; and 11 are governed by some type of state or county litter law.

A REPORT FROM MICHIGAN

WALTER O. DOW,
Engineer-Manager,
Emmet County Road Commission,
Petoskey, Michigan

THE COST of our current road building program is enormous and engineers are searching for places to cut expenses without lowering quality.

There is one place that has received comparatively little emphasis. I refer to the annual cost of picking up and disposing of litter on our highways. Though this is a maintenance item, it adds to the over-all cost of our highway system. Nationally, this cost runs into many millions of dollars each year and it is caused by the very people that must pay the bill, the traveling public.

It is hard to understand the thinking of people that keep their own homes and lawns spotless, yet drop sacks of garbage, tin cans, bottles, etc., from their automobile window.

Our County Road Commission has a contract to maintain the State Trunk Lines within our County. It is necessary that we pick up all litter, both for the sake of appearance and to prevent damage to roadside mowers. One spring clean-up alone resulted in an average of one 4-cu. yd. truck load of litter per mile on the 35 mile stretch of US-31 between Petoskey and Mackinaw City.

We have found no better way of picking up trash than by hand labor. We take one side of the highway at a time to prevent crossing the pavement through traffic. Men equipped with pitchforks pick up papers, etc., which are transferred to the accompanying truck. Bottles and cans have to be picked up by hand and placed in a sack, which is later dumped in the truck.

It is true that our problem (prior to the opening of the Mackinaw Bridge) was aggravated by deer hunters waiting in line for the ferries. This line had reached a length of 17 miles and these hunters, in line for hours, threw beer cans, pop bottles and lunch containers along the roadside.

Also, we live in a summer resort area and our traffic is probably 20 times greater in the summer than in the winter. This means that any program of education is not only a local problem but a national one. We have attempted a program of local education, however. The local newspapers have co-operated excellently and have carried stories and pictures urging people to stop littering highways. Schools have programs to discourage the practice of throwing litter. Our employees have urged friends and acquaintances to use litter bags and we have given talks at luncheon clubs and other groups asking people to help us achieve clean highways.

We know of several national campaigns to educate the public. The Leonard Refining Co. in our state put on an anti-litter campaign, advertising on TV, radio and by newspapers. They gave away paper litter bags at all their retail stations and

● **HAND methods of cleaning up roadside litter predominate. Of 457 counties reporting, 268 use men and trucks. Equipment to clean roadsides is vitally needed.**

offered to empty them at their stations.

We believe two approaches will help: 1) More national programs of education; and 2) stiffer penalties and more rigid enforcement.

Enforcement is admittedly difficult. It is not often that the police catch an offender and when they do, the Judge is apt to let them off easy. Michigan law specifies $5 to $100 fines, but, I have noticed the offender gets a $5 to $10 fine and costs. One deputy sheriff in our County caught some young men throwing beer cans onto the highway. He made these offenders pick up all the litter on ½ mile of road and stood over them till they had completed the task. This punishment, in my opinion, fitted the crime and was worth a dozen fines.

I am sorry to say, Michigan does not have effective signs warning motorists not to throw trash. Several states, notably Maryland, warns against throwing litter and specifies fines of $400 to $500. The roads that I have traveled in these states showed very little trash.

Probably we will never solve the litter problem completely, but if we could cut it in half by effective education, warnings and enforcement the effort would be well worth while. The money we saved on this item could be used to speed up our building program.

● **GRADER pulls trash from ditch and shoulders into windrows. Front-end loader picks up material for final disposal.**

A REPORT FROM KENTUCKY

L. T. SHEPHERD,
Clark County Road Engineer,
Winchester, Kentucky

IT COSTS fifty million dollars to clean the litter and garbage from the primary highways of the United States each year and it costs only forty-eight million dollars to operate the United Nations for the same period. Here in Clark County, located in Central Kentucky, in the heart of the Bluegrass region, 18 miles east of Lexington we have our problems like all other counties in trying to keep our highways clean and attractive to the traveling public.

There are a little over 300 miles of county roads and about 75 miles of State and Federal roads as well as streets in about 15 subdivisions to be kept clean after the litterbugs have tossed bottles, cans, papers and all kinds of trash and garbage to the side of our highways.

The County tried for six months to maintain a public garbage disposal area by establishing a dump in an abandoned railroad cut which was about three miles from Winchester by the side of a county road. This dump was about 1000 feet long, 40 feet wide and 10 to 14 feet deep and had signs posted at each end on where to dump the garbage. The Fiscal Court decided it was a health menace and a public nuisance and the dump was closed.

There is a privately owned concern that picks up garbage in the subdivisions for 40¢ per week per house. Most subdivision property owners subscribe for this service. The City of Winchester charges $2.00 per month to pick up garbage in the city limits and all taxpayers have to pay for this service as it is charged on their city water bill each month. If you do not pay for garbage pick up, your water service is cut off.

We have tried to appeal to the public by placing notices of trimming and cleaning the right-of-way in our local newspaper, and the papers have helped by having editorials urging the people to co-operate in keeping our county highways clean. It is costly to the taxpayers when we are ditching our roads every year as we so often run over broken bottles and cut grader and truck tires.

● **NO WEEDS, no brush and no trash are visible along this right-of-way, but litter problem remains in most areas.**

On wet days when we cannot do other road maintenance work we send out trucks and crews of men to pick up garbage and trash from roads by hand and by using pitchforks and shovels. We use a Hough Payloader to pick up ditch materials which are pulled out and windrowed by a Caterpillar patrol grader. After the Payloader loads the dump trucks the materials are hauled and dumped. We have been using an abandoned rock quarry on the side of one County Road for disposal. As it fills up, we burn and push back from the road into the old quarry and cover up the shoulder of the road so it will not look so unsightly to the public.

Every July we post at least 10 signs in every precinct and district of the County, advising the property owner of his responsibility to cut all weeds and brush, and trim all hedges and trees on property that abuts the County roads. Quite a few farmers are interested enough in the looks of their farms to do so; however, a lot of them never clean their right-of-way. There is a fine of $50 for every person who violates this law.

The County Road Engineer is fined $100 if he fails to publish these notices in the local paper and to post them all over the County for the property owners to see. We have always carried out our part of the law in publishing these notices but all the farmers do not carry out their part of the law. Our county has never made it a policy to impose fines on garbage violations.

SULPHITE LIQUID
AS A ROAD BINDER MATERIAL

R. A. BURMEISTER,
Materials Engineer,
City of Milwaukee, Wisconsin

ONE OF the striking sights to the air traveler in this country is the periphery of new housing around practically every city, town and hamlet. Another related observation is that often such new housing, built in a "crash" program, precedes permanent street pavement construction.

While this periphery of new housing is in itself a commentary on the vigor and progress of this country generally, it nevertheless poses an unusual problem to the city governments because residents in the newly developed areas demand a matching "crash" program for street pavements. They want dust-free and mud-free streets—all with budgets and tax methods of pre-war vintage. Boiled down to bare essentials it has become apparent that a new field exists for a really low cost, quickly constructed temporary street pavement, not competitive with permanent pavements such as the excellent portland cement concrete, asphalt and tar pavements presently available.

In an effort to resolve this problem of low cost temporary pavements, Milwaukee has been experimenting with sulphite liquid road binders which are chemically classified as mainly lignin sulfonate and are chemical byproducts of the sulphite wood pulping process. It is interesting to note that there are over 100 sulphite pulp and paper mills in the United States and Canada which "produce more than 30 million gallons of waste solution daily which contain 10 percent of lignin sulfonate and sugars in fixed proportions".* Hence this sulphite liquid attracted interest as a maintenance and construction material because it is a waste product,** available in large quantities, and therefore is likely to be a low cost item for years to come. Milwaukee started with sulphite liquids in 1956, and the first step after preliminary field trials was to evolve a specification for the sulphite road binder liquid.

* From Bureau of Mines Information Circular 7806, "Use of Lignin Sulfonate for Dust Control of Haulage Roads In Arid Regions," by John D. Harmon, October, 1957.

** A recently enacted Wisconsin statute prohibits dumping such liquids in State streams or rivers.

● **LIGHT traffic, left picture, has worn road surface somewhat, but sulphite application has held crushed gravel in place. Right: Heavy traffic has worn the surface to such an extent that aggregate is exposed, but surface is tightly bound.**

The specification for the sulphite liquid contains two principal items: 1) The sulphite liquid shall contain not less than 10 percent solids by weight; and 2) a cylinder made of sandy soil and bound with the sulphite liquid shall have double the strength of a similar cylinder wherein the soil is bound only by water. Soon after the specification was prepared a laboratory evaluation test of sulphite liquid was made. The subject was a sandy loam. This was moistened and placed in a cylindrical brass molding having an internal diameter of 4.0 inches and a height of 4.6 inches. Placement was in three equal layers and each layer was compacted by receiving 25 blows from a 5½ pound rammer dropping free from a height of 12 inches. (Proctor Method, ASTM D 698.) By repeating this test with various moisture contents it was found that the optimum moisture content was 9.2 percent by weight and the maximum density was 129.2 lb./c.f.

Three cylinders of soil so made were then placed in an oven at 160°F for 42 hours. Three cylinders of soil were similarly made and oven dried but instead of using water they were made with sulphite roadbinder liquid in such amount as to produce 2½ percent sulphite solids by weight of the oven dry soil. The cylinders were then dry tested in compression. The untreated soil cylinders had a strength of 420 lb./sq. in. while the sulphite liquor treated soil cylinders had a strength of 1455 lb./sq.in. In other words, the sulphite treated soil was 3½ times as strong as the untreated soil mixture. Thus it became apparent that sulphite liquor had road binding qualities. It should be remembered, however, that the test specimens were baked which gave them higher strengths than attainable in the field.

Table 1 shows approximate mileage of the various types of pavements within Milwaukee City limits.

This article concerns itself primarily with the building and maintenance of two types of temporary pavements from Item 7, Table 1:

a) Starting with a subgrade properly shaped, crowned and rolled to a specified line and grade: a 4-in.

● **METHOD of distributing sulphite liquor by tank truck. Note gravity flow from spray bar with splash board hanging under spray bar. Application is to top surface.**

layer of crushed stone (1 to 3 ins. in size) is added in one lift and then rolled. Then ¾-in. crushed road gravel is added in sufficient quantity to fill the voids in the crushed stone and provide a 2-in. thick layer of crushed road gravel above the crushed stone making a total thickness of 6 ins. Filling of voids is accomplished either by water flushing or rolling with a wobble wheel roller. The final 2-in. thick layer of ¾-in. crushed road gravel is rolled with a six-ton roller. Sulphite liquid is then applied.

b) In case of an old gravel road or a subgrade not built to formal line or grade such as may occur in newly annexed areas, the following procedure is used: If the old gravel road is in poor condition, the material is scarified and enough ¾-in. gravel is added to build up to an effective thickness of up to 6 ins. If the old gravel road is in good condition, the ¾-in. crushed gravel may be added only in those areas that need correction, such as pot holes, ravelled areas, etc. If little or no surfacing exists on the subgrade the ¾-in. crushed gravel is added to give an effective thickness of up to 6 ins. Sulphite liquid is then applied.

In 1956, there were 1,747,060 gallons of 10 percent solids concentrate and 288,813 gallons of 25 percent solids concentrate of sulphite liquid applied to 70 miles of streets at an average of 2.3 applications. The 10 percent solids concentrate required 14,500 gallons in individual applications per mile of street and the 25 percent solids solution was applied at 6,300 gallons per individual application per mile of street.

There were 6,313,676 gallons of 10 percent solids concentrate used in 1957, on 118 miles of street at an average number of applications of 4.15. Total gallons per mile of street were 53,365 or 12,859 gallons per mile in individual applications.

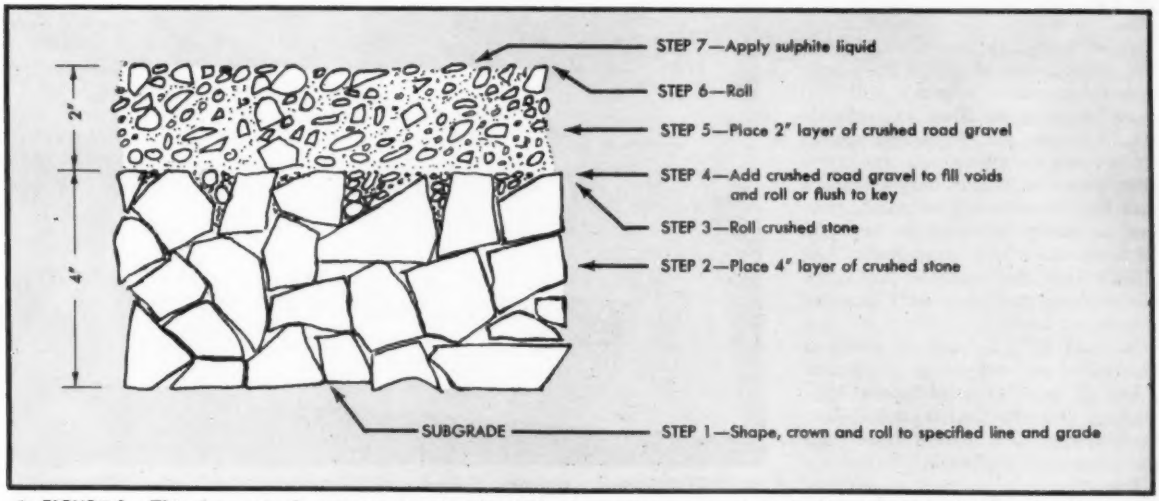
Last year 3,951,500 gallons of 10 percent solids concentrate of sulphite liquid treated 120 miles of streets at an average number of applications of 5.72. The number of gallons for individual applications were 5,754 per mile of street or 32,927 gallons per mile for all applications.

All streets were treated on the surface only; scarifying, windrowing, mixing, spreading and rolling as practiced on stabilization projects were not done. Most streets treated had gravel surfaces. The number of applications varied depending main-

Table 1—Pavement Types and Mileage

Item		*Mileage*†
1	Asphalt	680
2	Asphaltic Concrete	43
3	Tar Macadam	176
4	Tar Road Mix	63
5	Portland Cement Concrete	158
6	Brick	19
7	Temporary, various types	132
	Total	1,271

†Mileage is computed by using actual square yards of pavement divided by an average of 35.5 feet.


STEP 7—Apply sulphite liquid
STEP 6—Roll
STEP 5—Place 2" layer of crushed road gravel
STEP 4—Add crushed road gravel to fill voids and roll or flush to key
STEP 3—Roll crushed stone
STEP 2—Place 4" layer of crushed stone
2"
4"
SUBGRADE
STEP 1—Shape, crown and roll to specified line and grade

● **FIGURE 1—This shows step by step construction details for temporary pavements as developed by City of Milwaukee Engineers.**

ly on intensity of traffic, also to a lesser extent on surface texture and weather. Some streets had less than 4.15, the average for 1957, and some had more.

The contract unit price for 10 percent sulphite liquid applied to temporary pavement was $0.0146/gallon for 1957, and $0.0141/gallon for 1958.

Methods of Application

The methods of application varied for the sulphite liquid in 1956, 1957 and 1958.

Method 1. In 1956, before a specification was formally adopted, the sulphite liquid was delivered to the City by a contractor who used a 52 percent solids concentrate. This was diluted to 25 percent and the resultant liquid was applied by a home made pressure distributor converted from an old street flusher. The concentrate was stored in a 4,000-gallon tank mounted on a semi-trailer. These storage tanks were spotted next to a hydant near the work and City crews and equipment pumped the concentrate and additional water into the pressure distributor. This method allowed only 2½ miles of treatment in an eight-hour day.

Method 2. Since the amount of sulphite applied per day in Method 1 was deemed inadequate Method 2 was tried, in which the sulphite liquid was furnished to the City just as it came from the paper mill (without processing to form a concentrate) and in this condition it had about 10 to 12 percent solids. This sulphite liquid was trucked to the City in 4,000-gallon tankers equipped with splash boards and gravity feed. Using 8 to 10 trucks, each of which could make two trips a day from paper mill to job, the rate of application was raised to 7 miles or more a day. Economically, this method has the advantage of eliminating the steps of forming a concentrate at the paper mill and then having to re-dilute the sulphite liquid on the job. However, against these considerations are the facts that water is hauled long distances and that the amount of solids cannot be easily adjusted on the job. But so far field experience has shown that the sulphite just as it comes from the paper mill is satisfactory.

Method 3. This method involves the use of concentrate as in Method 1 but all work is done by the contractor. Gravity feed, splash board tank trucks are used rather than the pressure distributor.

Irrespective of method of application used, the sulphite liquid is applied to the top of the finished temporary street surface; it is never mixed in by scarifying, windrowing, blading, etc. The writer recognizes that some sort of a mixing process, (getting the sulphite liquid evenly distributed throughout the mass) would improve the quality of pavement, but feels that this is economically unsound; i.e., if this amount of work be done it is sensible to take one more step and utilize a true cement such as portland cement, asphalt or tar.

After initial application of sulphite liquid, additional applications are made depending on intensity of traffic, weather, texture of surface, etc. The rate of application depends on texture of surface, type of aggregate, gradation, etc., and can be adjusted in the field by changing the speed of the truck.

Field Observations

Some streets will remain dust free and mud free with only two applications of sulphite per year. Others require six or more treatments.

Good weather is needed in sulphite liquid construction and applications begin in early spring as soon as the frost leaves the ground. An early or late spring breakup influences the sulphite treating season as does the freeze-up in the fall. No work is done in freezing weather. Rain tends to wash out the sulphite, especially if rain occurs immediately after a treatment. During a long dry spell sulphite treated surfaces need little re-treatment.

A well-drained roadway is essential; good transverse drainage is necessary hence a flat crown is not desirable. A good criteria is ½-in. per foot side slope as a minimum.

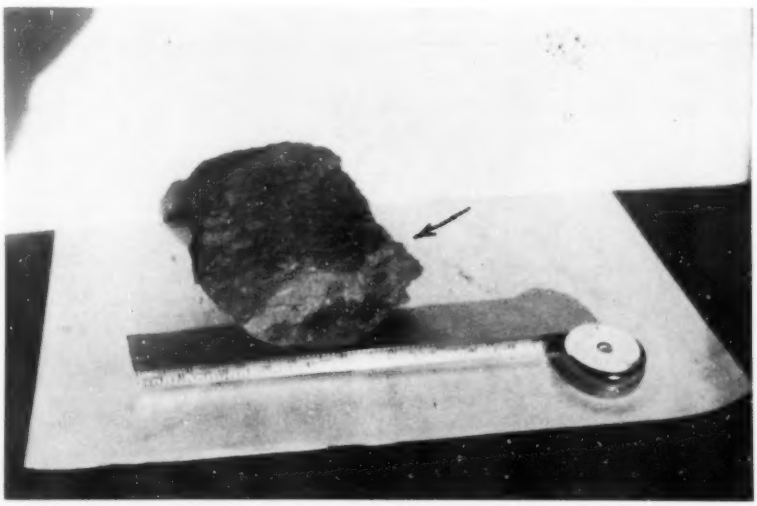
Repeated applications of the sulphite liquid has a tendency to create a build-up. If a street is heavily treated two years running, the third year only a small amount will be required.

For a street that has been recently gravelled and is of relatively loose texture, a one gal. psy application is usually adequate as a dust palliative and to start cementitious action. After several applications it will be found that the gravel will no longer absorb the sulphite as readily as before, hence a lighter treatment is used. If the gravel is of such texture that more than one gallon per yard is needed initially, it is better to use two light applications than one heavy one. Judgment is necessary to avoid excess use of sulphite liquid which may pond and form soft spots.

For 10 percent concentration, sulphite liquid has a viscosity about like that of water but on the hands it feels somewhat like orange juice —slightly sticky. It has an odor of wood pulp but this is not unpleasant For 25 percent concentration the viscosity is about like table maple syrup. For 52 percent concentration the viscosity is like that of a SAE 40 motor oil.

Cars accidentally sprayed with it can easily be washed clean with water; likewise it can be removed from the hands or clothing by water. No evidence of corrosion or other harmful effects has been noted on street appurtenances such as cast iron catch basins, or manhole covers.

Streets treated with sulphite liquid may be opened to traffic immediately.



● **SECTION from a sulphite treated gravel pavement. Road gravel is thoroughly bound together. Sulphite liquid is also an effective dust preventive treatment.**

SMALL CARS OR the "BIG THREE" FOR FLEET USE ?

WILLIAM F. HALLSTEAD

"WE USED to get four cars between columns in our parking garage," a utility company superintendent of transportation said recently. "Now we get only three." "We're buying several dozen small cars on a trial basis to reduce operating costs," says the fleet superintendent of a large southern city.

From all over the U.S. come reports of small cars on trial in fleets that have never before used any vehicle other than a Chevrolet, Ford or Plymouth. Is Detroit's styling seriously affecting the appeal of standard American cars for utility and government fleet use? Might the Rambler or Studebaker Lark or even some stranger from overseas replace Chevrolet, Ford or Plymouth as a standard fleet car?

Even the bitterest critic of imported and American-made compact cars cannot deny that they are easy to drive, park and house; that their initial cost is lower than standard American makes; and that operating costs are generally less. These virtues would seem to point the way to a switch in auto fleet purchases from Detroit's standard offerings to a list of new automobiles with names like Rambler, Lark, Anglia, Consul and Volkswagen.

Yet the fleet operator cannot base his selection of vehicles only on these three points: low initial cost, low operating expense and easy handling. When depreciation and individual preference come into the picture, the seemingly obvious advantages of small cars over large cars require a long second look.

In the course of this fleet operation study, the author has interviewed the transportation superintendents of a number of utility companies and has talked with representatives of Peterson, Howell and Heather, North America's largest long-term auto fleet management service (as compared to short-term services such as U-Drive-It and Hertz). The author's objective has been to determine if Detroit styling has affected the fleet selection and operation of its offerings, and to get an inkling of how much penetration small cars have made in the auto fleet field.

What Is Available?

To simplify comparison, consider the available fleet cars in these three categories: 1) The "Big Three"—Chevrolet, Ford and Plymouth; 2) the compact American-made cars —Rambler and Lark; and 3) imported vehicles.

Courtesy Studebaker-Packard Corp.

● SHORTEST of all domestic automobiles, the Studebaker Lark lessens storage problems and is used increasingly as a fleet car. Interior room equals most standard cars.

If Peterson, Howell and Heather's aggregate passenger vehicle acquisitions are typical of the general industrial field, then some 95 percent of total industrial fleet purchases are either Chevrolets, Fords or Plymouths. These domestic vehicles have been the accepted standard for many years.

The "compact" American-made cars, a term often used by American Motors, presently include that company's Rambler series and, as of the 1959 model year, the Studebaker Lark. Table 1 shows that the longest Rambler is 10 inches shorter than any of the 1959 Chevrolets and that the Lark sedans are 16 inches shorter than the Rambler sedans and even 3 inches shorter than the Rambler American. The narrowest of the Big Three is the Ford, 4 inches wider than Ramblers; 5 inches wider than the Lark.

In the imported car category, the variety is awe-inspiring. It is rather shocking to learn that well over three dozen individual makes of imported cars are currently available in the United States. Of these, the following are most often used as fleet cars: Anglia (and 4-door Prefect version) and Consul, made by Ford Ltd. in England; Volkswagen, made in Germany; Metropolitan, made in England for American Motors; and the Vauxhall Victor, made in England by a General Motors subsidiary.

A glance at the imported car portion of Table 1 reveals that without exception (though by a small margin, it is true, in the case of the Consul), these vehicles are shorter

and narrower than any of the American-made cars. As far as storage alone is concerned, these imported cars are the answer.

Average maximum brake horsepower ranges from a low of 90 for the Lark and Rambler American to a low above 130 for the standard three. Imported horsepower ranges downward to 36 for the Volkswagen and Anglia.

The prices shown are approximate retail prices without added equipment and local taxes, and are not to be construed as fleet prices. Fleet sales are often competitive within cities, and sometimes special arrangements with dealers and factories are made. Therefore, it is impossible to present an accurate fleet price list. The prices shown are for rough comparison purposes only, and are the approximate tabs for the cheapest sedan of each line.

The Case for the Small Car

Any vehicle other than Chevrolet, Ford, Plymouth and a scattering of other GM, Ford or Chrysler products must compete with solidly established reputations for reliability and good trade-in value.

Why, then, is there any possibility that fleet operators will switch in large numbers from any of these three fine old names to an untried product, perhaps to what might be considered a maverick in the automotive field? Up to a few years ago, there was practically no indication that they would, but as already mentioned, fleet men are encountering something called "modern styling". It's beginning to hurt.

Does the fleet buyer actually want "space for the space age" or a car that is "fresh, fine and fashionable", particularly when he pays a higher price to absorb the retooling costs of such styling progress? Fleet Chevrolets, Fords and Plymouths are not designed as such—they are designed primarily to sell to the individual consumer. General Motors feels that the "jaunty flair" of the 1959 Chevrolet rear deck will sell more cars to the unpredictable public. This same jaunty flair will be on Chevrolets used for fleets, although it means little to the purchasing agent of a utility fleet. And the fleet buyer of any of the Big Three will get the increased glass areas, multiple head and tail-lights and sweeping body styling that force repair and insurance costs upward. Purchase-price-wise, the compact and imported cars cost less. Model changes are minor, keeping retooling costs down. There is less material used in a small car, and in the case of imports, foreign labor is far cheaper than our own.

Something else the buyer of standard U.S. makes will get is increased size. The 1959 Chevrolet is almost a foot longer than the 1957 model. The 1959 Plymouth is 20 inches longer than the Plymouth of 1953. Ford's length has increased 10 inches in 6 years in the Fairlane series. Widths have increased about 5 inches in as many years.

All this means little, of course, to fleet operators whose vehicles are constantly on the road. For firms like the Baltimore Gas and Electric Company, though, this constant size increase has already created a serious problem of storage. The Baltimore utility's largest parking garage was built in the 1920s. Car styling of recent years has cut a third of its original capacity.

"Because in the interest of safety we discourage three persons riding in the front seat," says the gas company's transportation superintendent, "extra width doesn't help us at all. It just adds to our storage problem."

Increases in horsepower have added to the operating expenses of fleet cars. In place of a detailed analysis of comparative operating costs, this broad statement may be helpful: using an admittedly small sampling, Peterson, Howell and Heather have found that in running costs, the small cars average about 1¢ per mile less than the three standard fleet cars.

Repair costs and, consequently, insurance rates are generally less for the small cars. Of greater importance to anyone driving a fleet car intercity is the availability of service for his make car. Until quite recently, the Big Three held a very wide margin of service convenience. But with many Pontiac dealers servicing the Vauxhall; with Buick dealers handling the German-made Opel; and with Lincoln, Edsel and Mercury dealers offering convenient service on foreign Fords, this margin is being cut. It is still true that a man driving a Mercedes or Jaguar (there are a few of each on Peterson, Howell and Heather's roster) probably will experience more annoyance in seeking repairs in a small town than will the operator of a Chevy, Ford or Plymouth. The driver of a Vauxhall, however, will probably find service without difficulty.

From the ease of handling standpoint, the compact and imported cars (with standard shift) have an advantage over comparable stand-

Courtesy Checker Motor Co.

● **DESIGNED primarily for use as a taxicab, the Checker is roomy inside and is easy to get into and to get out of.**

Photo by Max Araujo

● **CONSUL, one of Ford's British line, seats six and is about the same size as the compact cars made in the USA.**

ard American makes. The author has driven a late model Chevrolet, Ford, Rambler, Rambler American, Lark, Volkswagen and Vauxhall Victor. There is no question but that the latter five cars were less taxing to drive in traffic, to maneuver and to park. On lengthy trips, the comparison becomes a bit clouded. Springing may be softer on the big cars, but on smooth new turnpike pavement, springs get little play—and soft ones contribute to excessive sway on high speed turns. As for head and leg room, any discerning driver has long since discovered that automobile exterior size does not necessarily correspond with interior room. The front seat leg room in the Vauxhall Victor, a 167-inch long car, is just 1 inch less than its luxury engine and shift commands a higher original price, it depreciates less than its cheaper versions.

Chevrolets, Fords and Plymouths are always available. Their builders operate experienced fleet departments and maintenance abounds almost everywhere.

Important to certain utility company uses, American-made cars are readily equipped with heavy duty springs and clutches. They can also be supplied with special generators putting out enough amperage to operate two-way radios when the engine is idling. Generators on most imports cut in only above 15 mph, and the imports cannot easily be had with special springs and clutches. Where automatic shift is wanted the

There are two general types of passenger car fleet operations:

1) Continually dispersed fleets such as those of intercity and interstate sales forces;

2) Local fleets that require daily dispatching and nightly storage such as those of municipalities and utility companies.

The firm of Peterson, Howell and Heather with more than 48,000 fleet cars and trucks represents a conclusive share of continually dispersed fleet operation. As of July, 1958, PHH had under its management only 77 Ramblers, 7 Rambler Americans and 33 imports—less than ½ of 1 percent of the cars under the firm's management. One PHH-managed fleet in Canada reported its Volkswagens easy to han-

Photo by Max Araujo

● **VAUXHALL Victor is a British car with a trend toward American styling. Total length is 167.8 ins., width 62.5 ins.**

Photo by Max Araujo

● **PREFECT, British built by Ford, is among the smallest cars used in fleet operations. Overall length is 149.8 ins.**

that of the 1958 Chevrolet Impala, a vehicle 209 inches in length. And the Vauxhall's front seat headroom is 2½ inches greater than that of the Impala.

Case for the Big Cars

A major point in the Big Three's favor is the stability of trade-in recovery. It is a matter of continuous record that other fleet cars do not bring a resale return percentage near that of similarly aged Chevrolets, Fords or Plymouths—with one recent exception. The Rambler station wagon is gaining in public acceptance, and public acceptance is what sets the trade-in price.

There are qualifications to the foregoing: it holds true if the Chevrolet, Ford or Plymouth is the top-line hard top with an 8-cylinder engine and automatic shift, and is traded at the optimum mileage figure between 35,000 and 40,000. Though this hard-top model with import again often falls short.

A Maryland utility company reports a strange psychological finding while testing small cars for fleet operation. This company operates several hundred passenger vehicles, about half Chevrolets, half Fords and a scattering of Plymouths. Now undergoing tests as fleet possibilities are several Rambler Americans and two British Anglias. One of these Anglias is in pool usage and, in the words of the traffic supervisor, "is not a success". It is turned in for minor repairs and adjustments far more often than the identical Anglia which is driven by only one man—who happens to be a small car enthusiast.

This same company feels that 8 hours of driver training is required for small car operation even though the small car has a standard American shift quadrant and the driver candidate has years of experience in standard makes.

dle in city driving and easy to park, but too small for comfortable long-distance operation. In the overall picture of dispersed fleet operation, there is little present use of compact U. S. cars or imports, and the outlook is heavily pro-Big Three.

Small Cars or Big Cars?

In the operation of localized fleets, however, the smaller car has a growing appeal. Utility companies and municipalities operating on slim budget margins and highly concerned with the initial cost of fleet cars plus their cost-per-mile find the small car quite attractive. If the fleet operator's policy is to amortize cost through high mileage and to consider trade-in return as secondary, then the case for the small car is strong. They save fuel, insurance and repair costs. Many makes restore practically all the storage area pilfered by recent size-styling.

American Motors Corp. released to the author a partial list of municipal and state departments using Ramblers for fleet purposes. This list shows that at least 117 departments of almost as many cities and states are using Ramblers—many, no doubt, on a trial basis. Among the city motor pools listed: Boston, Burbank, Hackensack, Pueblo, Zanesville; among the states: Wisconsin, Idaho.

From the City of Miami—operating no small cars at present—comes this comment: "We are going to purchase 56 Ramblers for trial—both for police and general pool use. We anticipate reduced operating costs with them."

A spokesman for Studebaker-Packard says, ". . . our product is being used in over 50 different public utility companies and in over 100 cities." This same source is of the opinion that "imports are of little importance in the public utilities field or for municipal government use. Customer and taxpayer resistance to the purchase and use of foreign-made automobiles would substantially hinder any mass purchase of the lower-cost imported automobiles." An interesting comment in the face of continually accelerating registrations of foreign cars in the U. S. For example, overall English Ford registrations in the U. S. during the first 10 months of 1958 were 26,551 against 13,717 in the same period of 1957.

From some of the nation's largest utility companies comes evidence of increasing interest in the use of small fleet cars. Says the Cincinnati Gas and Electric Company transportation superintendent, presently operating 4 Rambler Americans (among other cars, of course): "In all probability more Rambler Americans and some Studebaker Larks will be purchased in the 1959 budget." The general purchasing agent of Ohio Edison shows some feeling of disenchantment with the Big Three in this comment: "We are still going along with the standard models of Chevrolet, Ford and Plymouth. We are hoping that shortly some of the American manufacturers will begin producing a utility car that is more satisfactory to our type of operation."

Courtesy American Motors Corp.

● **RAMBLER American is a compact car (total length 178.3 ins.) which is being tested by a number of utility companies for fleet use to overcome size problems.**

Voicing a somewhat similar opinion, a representative of a large eastern utility indicated a specialized interest in the Checker, widely known as a taxi but available for general fleet application. The Checker Model A-9 is more than a foot shorter and about half a foot narrower than the standard three—and 6 inches higher. It is specifically designed as a taxi, consequently is roomy inside, easy to enter and leave. The utility is considering Checkers as executive transports because standard cars are becoming so low they require no small degree of maneuvering to get in and out of the seats.

Commonwealth Edison of Illinois is currently using "a few Ramblers, Larks and one Volkswagen", but these small cars have not been in service long enough to provide accurate operational data. Niagara Mohawk Power Corporation uses no small cars because, as a spokesman puts it, "most of the territory we serve involves topographical and weather conditions such that it seems doubtful that economies would be realized." Despite the negative indication of this statement, the director of transportation adds that Niagara Mohawk is "still considering small cars, however."

Across the country, small complements of compact cars are now undergoing trial. If they pass these demanding tests by utility firms, government agencies and industry—if small cars show themselves actually to possess all the advantages claimed for them—then there might well be brewing a revolution in the business of fleet purchasing.

Table 1—Data Chart on 1959 Car Models

Make	Approx. Retail Price (No extras except heater)*	Total Length	Total Width	Total Height	No. Cyl.	Max. Brake HP (Lowest HP Engine)
U. S. Standard						
Chevrolet	$2400	210.9"	79.9"	56.0"	6	135@4000 rpm
Ford	2400	208.0	76.6	56.0	6	145@4000
Plymouth	2400	208.2	78.0	56.6	6	132@3600
U. S. Compact						
Rambler American	2000	178.3	73.0	57.3	6	90@3800
Rambler Six	2200	191.1	72.2	58.0	6	127@4200
Studebaker Lark	2000	175.0	71.4	57.5	6	90@4000
U. S. Other						
Checker A-9	2200	199.5	75.0	62.8	6	95@3000
Imported						
Ford Anglia	1600	149.8	60.8	58.8	4	36@4500
Ford Consul	2100	172.0	68.6	61.5	4	61@4400
Metropolitan 1500	1800	149.5	61.5	54.5	4	55@4600
Vauxhall Victor	2000	167.8	62.5	57.6	4	55@4200
Volkswagen Sedan	1600	160.2	60.6	59.1	4	36@3700

*Includes transportation & "Make-ready", Middle Atlantic area.

● **CHIPPER blades have to be removed for sharpening about every 13 days. An impact wrench does a quick job. Four work crews service 100,000 street trees.**

BRUSH CHIPPING MACHINES *Pay Off in Six Months*

BURT ROUBOS
City Forester,
Park Department,
Grand Rapids, Michigan

THERE ARE some 100,000 trees strung out along the 450 to 500 miles of streets in Grand Rapids. Branches on these trees have to be trimmed to remove those that have grown so low as to interfere with traffic or with pedestrians and to improve the appearance of the trees. Another major phase of the work of our forestry division deals with removal of trees which have been attacked by Dutch Elm disease. Four work crews are involved, two on the trimming work and two topping diseased elm trees.

We used to load the trimmed branches on a flat bed truck and haul them to a dump where they were later burned. This was a costly and time-consuming operation. Some time ago we decided to try a wood chipper. Now we have four of them, one for each crew. The chippers, made by Fitchburg Engineering Corporation, are trailer mounted and are towed behind the trucks.

The branches and tree tops are fed into the chippers, which cut them up into pieces one to three inches long and blow them right into our trucks. We have built metal hoppers to enclose our trucks so that they can hold extra chips. One load of chips is equal to six of our old-fashioned loads of branches.

Here is why we figure that the chippers pay for themselves so rapidly. We save five man-hours per crew each day by eliminating extra trips to the dump because the wood chips are so much more compact. Also, we have one less man on each crew since we don't need a top loader on chips to level them off and stamp them down. That's an additional saving of eight man-hours per crew. Together these save 13 man-hours each day per crew. At $2.25 per hour, the saving is $30 a day, or around $600 a month per crew.

In addition, there are some other benefits. We no longer spend time watching the burnings at the dump. Also, we formerly had to do occasional paint jobs when cars parked in the streets had been scratched by branches sticking out of our hauling trucks. And finally, we have four or five men during the summer since we cut down on the labor of weeding. The chips take care of this for us by reducing weed growth around shrubs and other plantings.

Chips Valuable

We feel that chipping trees with Dutch elm disease reduces the danger of spreading the infection. These chips are not used, but are delivered to the city dump.

Branches from the rest of the trees do not end up at the dump,

● **SHRUBS are protected by putting a deep layer of wood chips around them. This shows how, at a school, the chips prevent packing of the soil by school children.**

● PARK Department uses wood chips around and under its trees and shrubs. The chips retain soil moisture and tend to prevent undesirable weed growth.

though. Once they are turned into brush chips, we find them useful throughout the city. They are spread under trees and shrubs in our parks, where they eliminate practically all the weeds. The chips hold in the moisture and the plants seem to grow much better.

At the Campau School, chips have been especially valuable around shrubbery. School children trample on the beds all the time. However, with the chips as protection, the soil doesn't pack down and with this better aeration the plants do well.

Like all machinery, there are certain maintenance costs with the chippers. We find these extremely low. For instance, the blades of the chipper have to be touched up every day, but this takes only fifteen minutes. The blades have to be resharpened about every 13 days. To do this, we remove them with a Thor impact wrench and slip in a spare set. Other maintenance is practically non-existent. Gas consumption is three or four gallons per day. All maintenance is easily paid for by the additional benefits which I have described but to which no dollar value has been assigned.

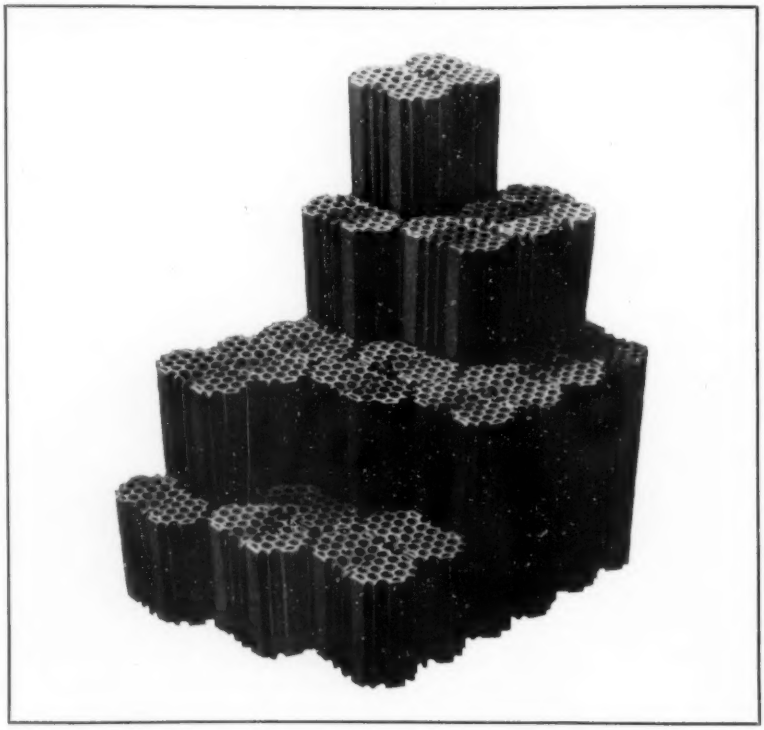
We figure that our four crews save the city $120 per day now that they are "mechanized." That's why I say that our new wood chippers are a grand investment—they easily pay for themselves within six months.

THE NEXT STEP FOR ECONOMY IN THE TREATMENT OF WASTES

R. L. SMITH,
and
H. C. LEIBEE,
Consulting Engineers,
St. Paul, Minnesota

FOR MANY years, the waste treatment work horse was the low rate biological filter. The introduction of the high rate and high capacity types of filters resulted in a major economy and today they more nearly represent the "standard" method of treatment. Now it is perhaps worthwhile to consider if we are not in a new stage that will produce as complete an economic change as did that from low to high capacity filters.

The low rate filter concept was based upon the use of equipment that could operate only intermittently and this operational method eventually was responsible for the theory that the micro-organic life required a rest period between feedings. The high rate filter uses



● TILE media is perforated with a maximum number of 1-inch vertical holes to provide greatest possible surface area.

shortened rest periods and heavier applications of food for the microorganisms but also includes recirculation of treated sewage. The high capacity filter completely eliminates the rest period and uses a feeding method that maintains a film of liquid conducive to the efficiency of the organisms present.

The flora is a composite of protozoa, worms, fungi and bacteria of which the bacteria are probably the predominant form in those filters where the pH of the wastes is close to neutrality or above. Dr. Henrici, formerly of the University of Minnesota, in his study of stalk bacteria, found a logical explanation of the physical functioning of the filter flora. The active microbial life is aerobic, the stalk bacteria being attached to the filter media. Furthermore, Dr. ZoBell of the University of California has demonstrated that many non-stalk bacteria attain higher populations where solids are present than in clear menstruum. Presumably, these microbial forms attach themselves to solid surfaces. The growth of these bacteria in large numbers creates a dense microbial "forest" that eventually prevents air from reaching the media surface. This leads to a condition wherein anaerobic liquefaction dissolves the attached element and causes the flora to slough. For the reason that the contact period between the sewage and the filter flora is less than ten minutes, compared to the hours of contact used in the activated sludge process, the design of the media is critical.

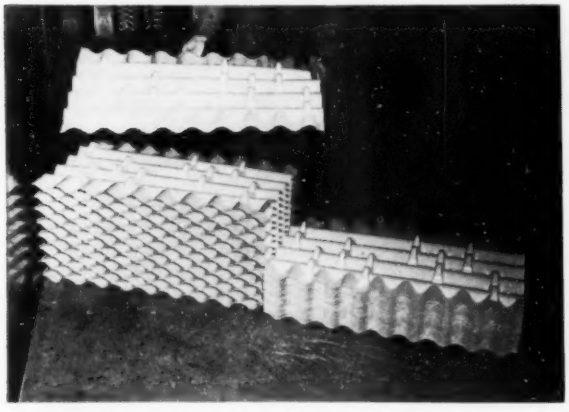
If broken stone is used as filter media, the sewage applied to the top of the bed will tend to channel and eliminate a large volume of the bed from use. The most desirable rock media would be perfectly round spheres of uniform diameter; these are of course impractical to obtain. In using the commercial form of broken stone, care should be taken to obtain a type of rock resistant to the chemicals present in sewage; to eliminate too many flat pieces and to provide adequate hand screening so that the rock pieces all approximate the same size. The actual cost of rock media is much higher than is usually estimated.

It is entirely reasonable to believe that a commercially feasible prefabricated media can be made that will provide up to ten times as much surface for useful microbial growth as any commercial grade of rock can provide. Materials available for a prefabricated media include Dowpac's polystyrene and saran, vitrified clay, glass, resistant metals, etc.

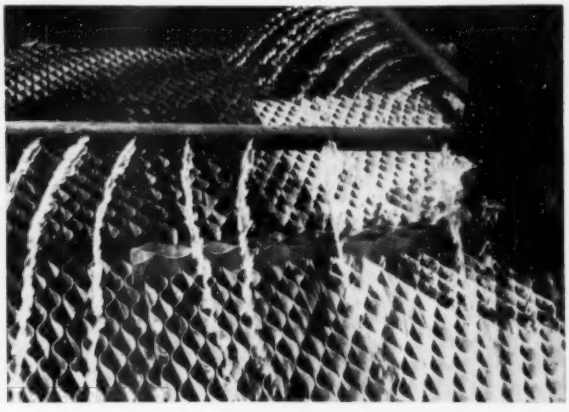
A prefabricated media must be fully resistant to chemical erosion from industrial and domestic wastes, must be reasonable in price and must be economical with respect to weight, reflected in haulage costs. The media must also have the highest possible "effective surface." Effective surface is defined as surface which will support active flora. The surface must be self-cleaning to prevent the accumulation of sludge pockets where anaerobic decomposition can occur with consequent return of part of the organic material to solution. As the flora can gap a ½-in. opening, all surfaces should be more than a half inch apart. The media structure should permit uniform film thickness to be maintained from top to bottom of the media. It should provide for adequate air movement, influenced by the difference in temperature of the air and the waste. When the air is heated, it will rise and when chilled, will descend. The actual amount of air required is probably less than one cubic foot per square foot of filter surface (not media surface) with a velocity of three feet per second. The creation of a uniform film at the top of the filter can only be accomplished by means of a uniform, rain-like application from the so-called high capacity type of distributor.

In general, the high loadings permissible with prefabricated media such as the vitrified clay Aeroblock and the product of the Dow Chemical Company known as Dowpac should produce very material gross savings in the plant cost.

It is reasonable to believe that the low capacity filter was designed with little consideration given to the chemical characteristics of the waste. There is a characteristic of sewage generally termed "susceptibility to oxidation" or "treatability." For any particular situation, this should be studied by a biochemist and a recommendation made based on peculiarities of the waste. There are certain heavy gases, probably sulfur compounds, that will accumulate near the bottom of a filter and prevent satisfactory treatment. It is not believed that the increase in BOD loading permitted by the high hydraulic loadings possible with prefabricated media implies that any more consideration should be given to treatability than would be the case were the filter of the low capacity type. Treatability is always part of judging any waste process and the use of prefabricated media does not obviate the need for sound design of all treatment plant units.



● **DOWPAC is a plastic media for trickling filters. At lower right, sections are shown nested for transportation.**



● **TOP VIEW of a filter utilizing Dowpac. High loadings permissible with prefabricated media can reduce plant cost.**

Drill Machine *Used In Sewer Construction*

T. EDWARD TEMPLE,
City Manager,
Danville, Virginia

THREE YEARS ago the City of Danville, Virginia, embarked upon a $700,000 sewer construction program which at the outset presented many construction problems. Highways and railroads had to be crossed; a time-saving and money-saving approach to these tasks had to be found.

Up until 1955 the job of laying a sewer line under railroad tracks had been done by tunneling and jacking large pipes under the tracks. The pipes had to be large enough for a man to work in to bring the dirt out. Once the tunnel was completed, the smaller sewer line could be laid through the tunnel of pipe. The job took days to complete and required installation of pipes larger than actually needed to encase and protect the sewer line.

To cross highways, construction crews had to dig their way across, tying up traffic, exposing men to swift-moving cars and trucks, and, in cases where pavement had recently been laid, tearing up surfacing which could never be adequately patched again.

To solve these common municipal headaches, a widespread search was made by Director of Public Works H. D. Bowling to find a machine that could do the jobs required.

Machine Requirements

The machine would have to be versatile so that it could be used on the major jobs and also on more routine work. It not only would be called upon to drill for long distances, but also had to be used to drill a hole along a specified grade with a high degree of accuracy.

The result of the investigation led to the purchase of a McCarthy Trench Machine, Number 103TT, with a 32 hp Wisconsin air cooled motor. Along with the machine, the city purchased 54 feet of 6-inch and 54 feet of 20-inch augers, which come in 6-foot lengths. Since the initial purchase additional lengths have been bought making a total drilling capability of about 75 feet.

During the past three years, the machinery has been used extensively by the Sewer Construction Division to bore under railroad tracks, major highways, and residential streets to make sewer taps and install trunk sewers. It has been loaned to the City's Water, Gas and Electric Department and the local telephone company for major jobs.

● **DRILLING is a much easier and less costly method of getting sewer or water lines under streets, railroad tracks and four-lane highways; and it is safer, too.**

On the railroad jobs, it has been estimated that less than one-fourth the time is needed to complete the work, cutting the time from days to hours.

Installation of Pipe

The way that construction superintendent Jack Eggleston installs an 8 or 12-inch line under the highway is to begin by cutting a 6-inch pilot hole, which is then followed through using the 20-inch augers. Into the large hole is pushed a casing which serves to protect the sewer line. Sometimes the casing used is smooth steel pipe, and sometimes a corrugated metal pipe is inserted and welded.

Although no trouble is encountered when drilling on a horizontal line for any distance, extreme care is required to drill along a specified grade. In fact, Danville experience indicates that when drilling to grade, no more than 75 feet should be bored from one point. If a job requires greater distance along a grade line, the machine should be moved to drill from the other end.

Although no cost figures could be accurately applied to determine savings over the past three years, Danville officials feel that the investment has proved valuable. The trench machine is used only on certain major jobs, but on those jobs the installation time required and the costs are materially reduced. The construction men no longer are exposed to the hazards of traffic. Traffic on major highways is no longer blocked by open ditches, and high class pavement is preserved from innumerable cuts and patches.

Mr. Bowling feels that had the machine been discarded long ago, it would still have paid for itself. Today, with every use of the McCarthy Trench Machine, the City of Danville receives added dividends.

● **OLD WAY of jacking under a railroad. Note the laborer is pushing a tray of dirt out of the 36-inch pipe.**

NEWS BULLETINS

AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Samuel S. Baxter Honored as Philadelphia's "Engineer of the Year"

Philadelphia, Pa. — Sam Baxter, Water Commissioner, City of Philadelphia, was honored as Philadelphia's "Engineer of the Year" during National Engineer's Week, February 22-28, 1959. Presentation of the award by the Pennsylvania Society of Professional Engineers was made at a luncheon at the Philadelphia Engineers' Club, February 20. Thus in the image of Sam Baxter, outstanding public servant and a past president of APWA, "is an outstanding example that a professional man can have an effective and satisfying career in the service of his city."

Simpson Appointed to ASA Masonry Committee A-41

Chicago, Ill.—President Hurst has appointed E. G. Simpson, Deputy Commissioner of Buildings, Engineering Department, Winnipeg, Manitoba, Canada, to represent the APWA on the ASA Sectional Committee A-41 on Masonry. The Committee is currently engaged in revising ASA Standard A-41.2 "Proposed American Standard Building Code Requirements for Reinforced Masonry".

Hardenbergh, Offner, Wagnitz Re-Appointed Trustees of APWA Research Foundation

Chicago, Ill.—W. A. Hardenbergh, Editor of Public Works Magazine; Milton Offner, Secretary of the Los Angeles Board of Public Works; and Milton F. Wagnitz, City Engineer, Detroit have been re-appointed by President Hurst to 3-year terms on the Board of Trustees of the APWA Research Foundation. By action of the Trustees, Milton Offner was re-elected Chairman, and Samuel Baxter, Commissioner, Philadelphia Water Department, Vice-Chairman of the Board. Continuing to serve as members of the Board are Don Bloodgood, Professor of Sanitary Engineering, Purdue University; Myron Tatlock, Consulting Engineer; William Foster, Editor, The American City Magazine; E. J. Cleary, Executive Director, Ohio River Valley Water Sanitation Commission; and F. H. Zurmuhlen, Commissioner, New York City Department of Public Works.

Manitoba Chapter Undaunted By −30° F

Winnipeg, Man.—Despite temperatures which fell to −30° F., a total of 59 members and guests of the Manitoba Chapter attended a dinner meeting held January 30th at Winnipeg. N. S. Bubbis, General Manager of the Greater Winnipeg Water and Sanitary District spoke on the Water District's new branch aqueduct.

Michigan Chapter Sponsors Inspector Schools

Detroit, Mich.—The Michigan Chapter, in cooperation with The Concrete Pipe Association, The Clay Pipe Association and the Portland Cement Association has sponsored schools for Sewer Inspectors and Concrete Paving Inspectors. The schools, one day each in length, were held February 24 and 25 and March 3 and 4 respectively; each course was held on consecutive days in order to reduce the size of classes and enable cities to send inspectors on alternate days. The City of Detroit served as host. The all-day sessions were held at the Detroit Western Yard.

APWA Representative Reports on Highway Research Board Meeting

Chicago, Ill.—David M. Smallwood, Philadelphia's Street Commissioner, represented the APWA at the 38th Annual Meeting of the Highway Research Board held in Washington, D. C., January 5-9. Commissioner Smallwood reported that a total of 200 individual papers were presented at the several concurrent divisional sessions. About 40 papers emphasized the strictly urban problems of expressway design, operation, traffic patterns, effect on adjacent land values, as well as various facets of traffic flow in arterial streets. Throughout the meeting the inter-relationship of highway transportation and urban problems was stressed.

Medford Elected President of North Carolina Chapter

Raleigh, N. C.—H. L. Medford, Director of Public Works, Greensboro, North Carolina, was installed as President at the annual dinner meeting of The North Carolina Chapter held in Raleigh, February

OFFICERS: Wm. D. Hurst, Winnipeg. Manitoba, Canada, *President;* Jean L. Vincenz, San Diego, Calif., *Vice President.* REGIONAL DIRECTORS: (term ending 1959) Albert G. Wyler, New Orleans, La.; Edward J. Booth, Bismarck, N. D.; Frederick Crane, Buffalo, N. Y.: (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth, Tex.; (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; W. A. Bowes, Portland, Ore. *Immediate Past President,* Sol Ellenson, Newport News, Va. Robert D. Bugher, *Executive Director.*

Read how FITCHBURG CHIPPER SOLVES BRUSH DISPOSAL County of Bergen, N. J.

OFFICE OF SUPERVISOR OF ROADS
COUNTY OF BERGEN

70 ZABRISKIE STREET
HACKENSACK, N. J.

J. ERNEST THIER, SUPERVISOR
DIAMOND 2-1350

May 26, 1958

Mr. W. O. Forman, President,
Fitchburg Engineering Corp.,
Fitchburg, Massachusetts.

Dear Mr. Forman:

I thought I would take five minutes out to inform you about the efficient work your Fitchburg Chipper is doing in Bergen County.

As you probably well know, this Department maintains 450 miles of County road, much of it in the rural area, and formerly, when cutting brush, we had to use a large dump truck and three men to load it, and we were then faced with the problem of disposing of this brush, which was a job in itself.

Since purchasing the Fitchburg Chipper we only need one or two men and a pick-up truck to haul it, and we are not faced with the problem of disposing of this roadside brush, as the wood is now chipped along the roadside to form a soil-improving mulch.

Yours very truly,

Supervisor of Roads.

Free Booklet

Perhaps the savings in man hours and equipment mentioned by Mr. Thier in his letter may apply to your city, town or department.

For further information on how a Fitchburg Chipper can benefit your operation, send for FREE BOOKLET: ***"Chip Dollars from Your Overhead."***

Address Dept. PW-49

FITCHBURG ENGINEERING CORPORATION
FITCHBURG, MASSACHUSETTS

12. The meeting was held in conjunction with the Fifth Annual North Carolina Municipal Public Works Conference which is sponsored by the North Carolina League of Municipalities and the Civil Engineering Department of the North Carolina State College in cooperation with the Chapter. Other Chapter officers installed at the meeting were R. W. Neilson, Director of Public Works, Winston Salem, Vice President, and S. Leigh Wilson, Assistant Executive Director, North Carolina League of Municipalities, Secretary-Treasurer. Warren Mann, Director of Public Works, Raleigh, and W. T. Cox, City Engineer, Ashboro were elected Directors.

"Graduation" Feature of Chicago Meeting

Chicago, Ill.—One of the featured events of the Chicago Metropolitan Chapter's annual winter luncheon meeting held March 10th was the awarding of certificates to the 32 participants who satisfactorily completed the Chapter-sponsored course on Municipal Public Works Administration. The course, sponsored in the Chicago area by the Chicago Chapter in cooperation with the University of Chicago's center for Programs in Government Administration, consisted of 12 afternoon sessions, the final session being held February 4. The certificates awarded were issued jointly by the APWA and the Institute for Municipal Training. They were the first given after recently completed arrangements for the Association to serve as co-sponsor of the Training Course in Municipal Public Works Administration offered by the Institute for Training in Municipal Administration which functions under the auspices of The International City Managers' Association.

University of Pittsburgh Site of Western Pennsylvania Chapter Meeting

Pittsburgh, Pa.—Subdivision control, certification of sewage treatment plant operators, and quasi-public agencies were topics for discussion at the February 5th meeting of the Western Pennsylvania Chapter, American Public Works Association. Fifty-two members and guests attended the Chapter's winter meeting which was held on the campus of the University of Pittsburgh.

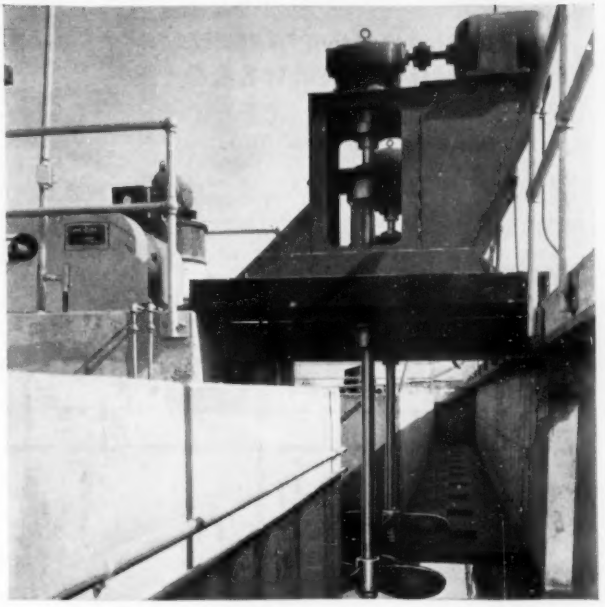
At the morning session C. B. Mitchell, Michael Baker Engineers, reviewed the "Municipal Authority" Act in Pennsylvania, and L. W.

WHICH MIXING EQUIPMENT

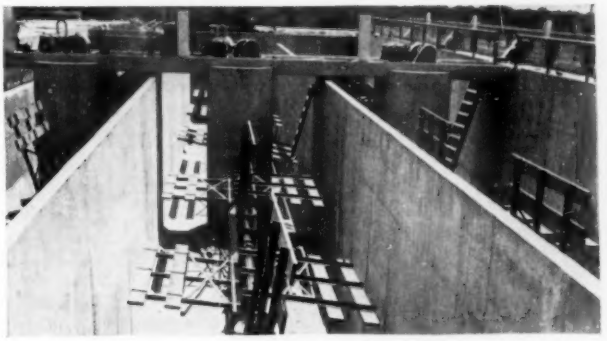
provides most efficient flocculation?

LINK-BELT's combination of flash and straightline mixers assures chemical savings of 30 to 40% . . . increases filter runs by 50% . . . decreases wash water demands

FLASH MIXERS PROVIDE RAPID, THOROUGH MIXING of chemicals with water, sewage or industrial liquids. They consist of a constant-speed motor directly connected to a quiet-operating worm gear reducer. This drive, mounted on a pedestal, is connected to a vertical propeller shaft so mounted that *underwater bearings are not required.* Load and thrust of the propeller shaft are taken up by bearings in the pedestal so these forces do not act on the reducer bearings. This efficient design assures long life and trouble-free operation. The propeller itself is an iron casting designed for high mixing efficiency with low horsepower requirements. Link-Belt flash mixers may be installed in concrete, steel or wood tanks by mounting on a steel or concrete platform spanning the tank walls.



STRAIGHTLINE MIXERS PROVIDE GENTLE SLOW MIXING to build up maximum size floc. These mixers consist of a number of sections, each made of a horizontal solid steel shaft carrying steel angle arms on which redwood paddles are mounted. The paddle shaft is driven by a chain drive from a Link-Belt Electrofluid drive coupled to a Link-Belt P.I.V. variable speed drive. The solid steel paddle shaft, with rigid compression couplings insuring perfect shaft alignment, turns in special babbitted bearings with water lubrication grooves. These bearings eliminate grease contamination of the water and prevent breakdown that may be caused by failure to provide proper lubrication. Use of redwood for paddles eliminates painting maintenance. Link-Belt makes a complete line of these mixers. Size and shape can be adapted to suit local requirements.



The mixers shown above are part of the broad line of Link-Belt sanitary engineering equipment. Get in touch with the Link-Belt office nearest you. Our sanitary engineers will be glad to work with your engineers, chemists and consultants . . . help you get the finest in modern treatment methods. Or write for your copy of Equipment for Chemical Flocculation Book 2442.

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Rugged, Inexpensive VERMEER

POW-R-DITCHERS

If one of your problems is low-cost, time-saving trenching and ditching . . . take a look at the VERMEER POW-R-DITCHER line before you buy! The 524T (above) digs 8" to 24" wide. The 4T (right) digs 6" to 14" wide. Both are fast, rugged, self-propelled and low in price. Ideal for digging foundation footings, gas, water, sewage and service lines. A third smaller unit also available.

Write For Literature and Low Prices On The Complete Line

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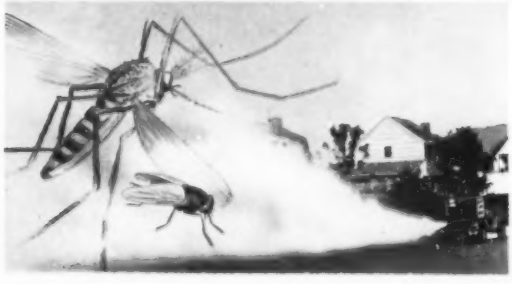

MOSQUITOES, FLIES AND OTHER INSECT PESTS

DESTROYED ON CONTACT

TIFA

TODD INSECTICIDAL FOG APPLICATOR

Lowest-Cost Space Control throughout the Community

On the dump, over pools, in suburbs, play areas, stockyards, TIFA gets the kill every time . . . at the lowest operating and maintenance cost. TIFA rapidly covers large areas with true clean fog, penetrates smallest crevices, envelops and destroys all insect pests. This efficiency with newest or older type insecticides, gives you a better insect control program for your community.

Carrying Underwriters' Listing Seal MH 4162

BEST by TEST for over 14 years in Community Fly and Mosquito Programs

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Pribble, also of Michael Baker Engineers, discussed the need for proper street planning and how street design affects a municipality. "Certification of Sewage Treatment Plant Operators" was the topic of the paper presented by T. R. Haseltine of Chester Engineers. Mr. Haseltine discussed the mandatory program proposed by the Pennsylvania Sewage and Industrial Wastes Association and the Pennsylvania Department of Health. Robert R. Perry, Engineer, City of Meadville, led the discussion which followed each of these papers.

The luncheon session featured a talk on subdivision control by Edward Yost, Assistant Director, Pittsburgh Regional Planning Association. Frederick W. Crane, General Manager, Buffalo (New York) Sewer Authority and Director, Region II, APWA, presented a Certificate of Appreciation Award to the City of Meadville for maintaining public agency membership in the national organization for 10 consecutive years.

Air Pollution Topic at Northern California Meeting

Oakland, Cal.—Benjamin Linsky, Control Officer of the Bay Area Air Pollution Control District reported on the progress and problems of controlling Air Pollution in the Bay Area at the regular monthly meeting of the Northern California Chapter, February 20. Mr. Linsky was assisted in the discussion by H. C. Johnson, Principal Air Pollution Control Engineer of the District.

• • •

Financial Planning

(*Continued from page* 119)

Types of Financing

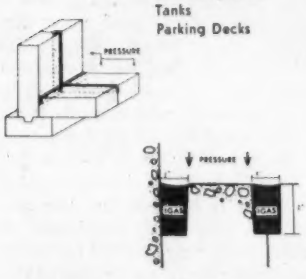
Many jurisdictions will find it advantageous to finance some of their improvements with general credit obligations and some with revenue bonds. Both types of obligations have their advantages and under certain conditions their decided disadvantages. In practice many variations and combinations have developed.

An issuer can usually, but not always, obtain a lower rate of interest on a general obligation bond issue than on a revenue bond issue. Investors have a high regard for the unconditional pledge to raise the money required for debt service at all costs. Ordinarily the other covenants need not be particularly restrictive in this type of issue. Since a general obligation is a direct debt of the issuer a new offering increases

EFFECTIVELY SEALED

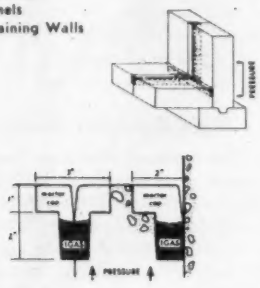
TYPE A — FACE PRESSURE

Water Reservoirs
Swimming Pools
Tanks
Parking Decks



TYPE B — BACK PRESSURE

Basements
Tunnels
Retaining Walls



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Vertical, horizontal and overhead joints are effectively sealed with Igas . . . It is self-welding, forms a continuous watertight seal . . . Intersecting joints can be sealed easily . . . Igas is a tough, resilient and non-meltable black mastic compound, adhering to any construction material . . . It remains flexible over a wide temperature range — does not sag or flow in hot weather, nor become brittle in cold . . . It will not dry out, shrink or lose its effectiveness even after years of exposure . . . Igas is non-toxic and will not affect drinking water . . . It is resistant to sewage, salts, non-oxidizing acids, dilute acids and sea water . . . Write for bulletin IS-56. For detailed recommendations on sealing joints contact our Technical Service Department.

IGAS is available in 4 consistencies to fit your job — pressure grade • knife grade • gun grade • extrusion grade . . . also available in gray color, in gun grade and knife grade.

26-31

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PASSAIC · NEW JERSEY
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2-Color, 3-Gun Machine
One-Man Operation
Self-Propelled
36 Gal. Paint Capacity

Here's a big production line marker for growing cities and progressive counties. Model 16 features include: automotive-type drive with 2 speeds forward, one reverse; lays two lines continuously, or three lines intermittently at 6 m.p.h.; automotive-type steering; many other quality advantages.

COMPLETE LINE OF STRIPERS, from hand-propelled models to custom-made, truck mounted units. Get more information now! M-B Corporation, New Holstein, Wis.

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PACKER BODIES LINE MARKERS SWEEPERS

CUT HIGHWAY MILEAGE COSTS with WARN® HUBS on your Jeep® 4-wheel drive!

Models for all makes 4-wheel drives to 1½ tons

SAVE REPAIRS, GAS, TIRES!

More pep, easier handling, too!

When a 4-wheel drive with Warn Hubs is used in 2-wheel drive, there's no "dead load" drag from the front drive assembly being turned by the front wheels! Warn Hubs save gears, engine, tire wear and gas; give your 4x4 the pep, speed, performance, handling ease of a 2-wheel drive. You can use 2 or 4-wheel drive whenever you want it—automatically with Warn Lock-O-Matics, manually with Warn Locking Hubs. Get Warn Hubs at your dealer's soon!

STOP FRONT DRIVE WEAR, DRAG AND WHINE IN 2-WHEEL DRIVE!

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the debt rates and also the amount subject to the debt ceiling if there is one. When the debt is already high local officials are often inclined, therefore, to avoid, where possible, the further use of general obligations.

Where user taxes are feasible, revenue bonds can often be used to advantage. From the viewpoint of the issuer this type of financing may seem especially attractive since revenue bonds are usually not included as debt in the computation of debt ratios, and would not ordinarily be subject to the debt ceiling, if there is one.

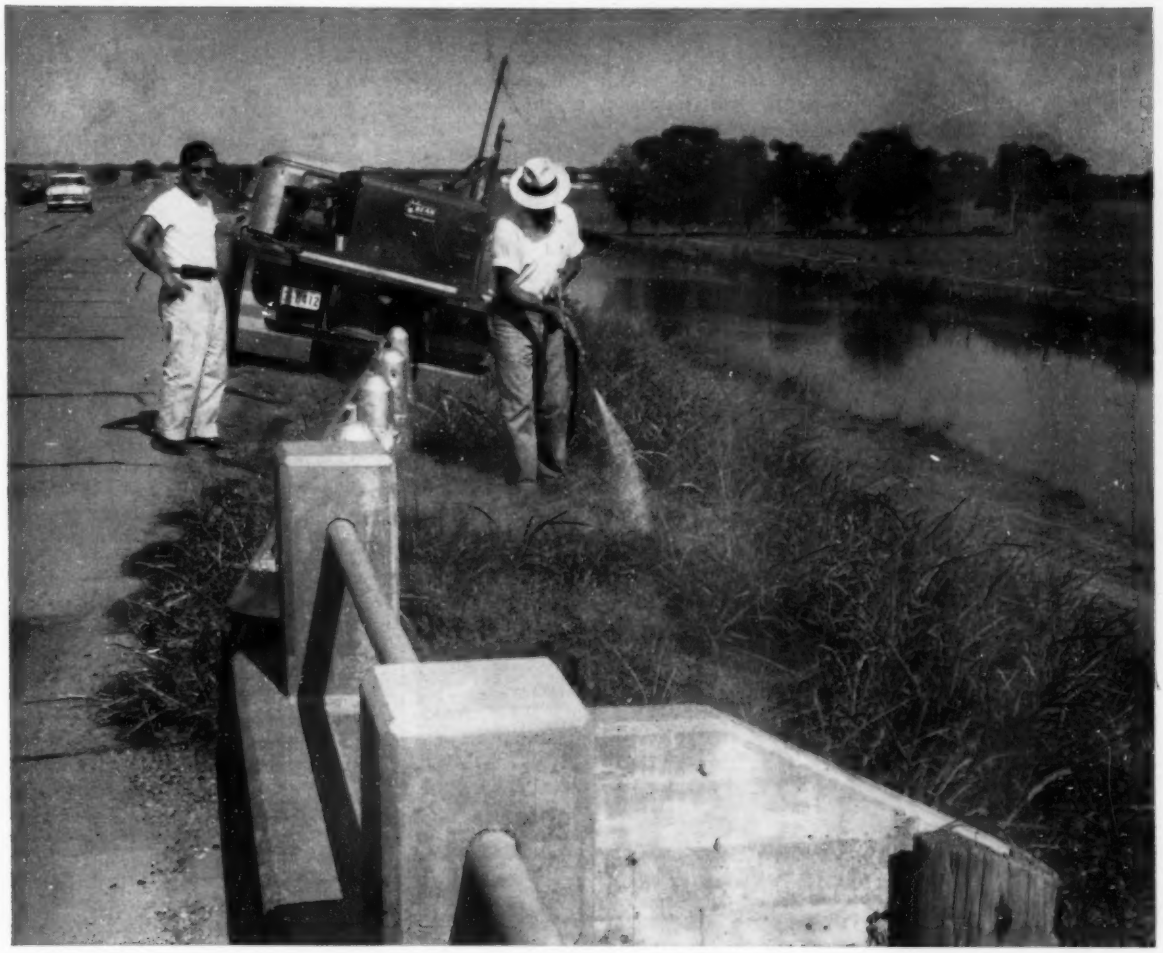
Hazards of Revenue Bonds

Two types of potential sources of danger should, however, be considered before issuing revenue bonds: 1) The user taxes may be insufficient to cover debt service—even though the general credit is not pledged the fact remains that any default is a blot on the record which must be explained. One of the greatest risks of revenue financing is the danger that debt service requirements will be based upon an overly optimistic estimate of earnings particularly in the earlier years. Currently, the officials of certain of the toll roads are sweating through a very uncomfortable period because of the slowness with which traffic is building up. 2) In the enthusiasm to get the bonds sold rigid covenants may be placed in the indenture which will later interfere with efficient management. Some years ago a publicly owned utility sold a series of bonds which carried a group of covenants requiring that cash receipts be routed through thirty-six separate accounts. This, of course, resulted in a confusing maze, which made it all but impossible to manage the enterprise. Fortunately there was a decline in the level of interest rates which made it feasible to take advantage of the call provision. A refunding issue was drafted in which the covenants were more workable. Another dangerous type of restriction ties up the funds so tightly that it is not possible to maintain the properties adequately. Fortunately this latter type of covenant is seldom found in the new issues.

Rigid Debt Structures

In the course of time the debt structure of a populous jurisdiction is likely to become both complicated and rigid. Much of the enabling legislation was passed years ago and does not fit modern conditions. Furthermore, outstanding bond issues often contain covenants which

DOW | HERBICIDES



GARLON . . . *"mows" weed costs along guard rails, bridge abutments*

Mowing around guard rails is a mean job. Time consuming, costly and not very satisfactory. But there is an easy and inexpensive way to do the job—with vegetation control chemicals. Specifically, Garlon*—the newly created weed and grass killer from Dow research labs.

Garlon controls grass and weeds at a fraction of the cost of mowing. This combination chemical kills both broad-leaved weeds and grasses. And it can be sprayed at any time when weeds are young and growing, with sure results. Garlon is the fast-acting versatile herbicide that's easy to mix, easy to use. It's the ideal supplement to right-of-way mowing around guard rails, road signs, bridge abutments and all hard-to-reach areas.

Where brush is a roadside problem, Veon* 245 knocks it out. In fact, there's a specialized Dow formulation for every roadside vegetation problem—weeds, grasses or brush. And a planned *chemical* control program gives surer control at progressively lower costs each year. For additional information on use of chemicals in roadside maintenance write to THE DOW CHEMICAL COMPANY, Midland, Michigan. Agricultural Chemical Sales Department 205 EC 4.

*TRADEMARK OF THE DOW CHEMICAL COMPANY

The Dow Chemical Company
Agricultural Chemical Sales Dept. 205 EC 4
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☐ Please send me additional information about roadside vegetation control chemicals.

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are difficult to live with. These unfortunate restrictions may take a number of forms. One of the more troublesome for growing communities is that of "dedicated revenues," whereby the proceeds of a specific tax are pledged to a particular series of bonds. This may make the new offering sell more easily, but such a practice carried very far will distort the revenue system badly. High coupon noncallable bonds can also be very frustrating when refunding seems desirable. Mandatory call features if not carefully designed may not work out well. Recently, one of our very large cities was forced to make a partial call at a premium for sinking fund purposes, when it would have been much more satisfactory for all concerned to have purchased the bonds in the open market.

When the laws are antiquated, and there are many bond issues outstanding with burdensome covenants, evasion of the restrictions seems to be the only feasible solution, but this is a costly way out. At best it extends present troubles and at worst it adds to them substantially. Evasions create reservations in the minds of prospective investors who will not purchase the bonds except at a price concession which may be substantial. Furthermore the costs of administering the awkward debt structure which results from a program based upon expediency may be large. The fact that there are obstacles to overcome in developing a reasonable debt plan indicates that such a reform is overdue.

Retirement of Debt

The tradition in municipal finance of periodic debt retirement has made an important contribution to the fine record which these bonds enjoy. There is, however, considerable more to developing a sound plan for debt retirement than dividing an offering into a stated number of maturities. The debt retirement plan should provide for (a) the retirement of principal at least as rapidly as the capital assets acquired with the proceeds depreciate; (b) declining debt service on existing debt—otherwise there is no room for the servicing of emergency issues, and even the servicing of offerings required to provide capital facilities made necessary by growth are likely to result in a rapidly ascending cost of debt service; (c) a maturity schedule which does not add undue rigidities to the budget.

A debt retirement plan can be developed around either a sinking fund or around serial maturities. The abuses in the administration of sinking funds received so much publicity during the Great Depression that they fell into disrepute and are seldom used today. A large proportion of current offerings are in serial form, some with a large maturity at the end commonly referred to as a "balloon." In this case provision is usually made to retire a part or all of the last maturity by call in advance of the due date.

The use of serials has the practical advantage of getting some debt retired, although the popular type of schedule with light maturities in early years makes this a slow process. Not all of the results of the widespread use of serials are good. Two disadvantages of this should be considered carefully: 1) The spreading out of maturities over a period of twenty or thirty years results in rigidities for the issuer. In good times the rate of retirement should be speeded up. Perhaps wider use could be made of balloon maturities, with a definite program of calling bonds in prosperous years. There are sound reasons for drawing off excess funds, since a large uncommitted cash balance is likely to make the refusal of demands for increased expenditures difficult; 2) The spread-

"Cuts maintenance to the bone"

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SPEED INSTALLATION

To the natural advantage of light weight, Tassco provides these aluminum signs in pre-arranged packages ready for installation. The easy-to-handle panels are assembled on the job site and mounted in a matter of minutes.

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North Carolina's signs feature the approved reflectorized green background with white AGA letters. However, reflective material or painted backgrounds are available in any type letters or symbols.

Helpful data, including a full color movie, is available from the Tassco-P & K Highway Planning Committee. Write for "Committee Data" today.

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They LOOK alike...

BUT...

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NEW from KERRIGAN — THE CLASSIC Pat. Pending

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Weldforged TRADEMARK LIGHTING STANDARD DIVISION

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THE FORMS OF KERRIGAN

ing out of the serials results in a thin secondary market. As the total volume of outstanding tax exempt bonds increases, the number of separate issues grows even faster. It is often difficult for holders to find buyers for the particular issues which they wish to move while prospective buyers are having trouble finding the particular bonds which they wish to acquire. Consideration might well be given to having serials mature every second or third year instead of annually. Since many local governments are in the market quite often they could arrange to have some maturities every year.

Co-ordinating Policy Decision

At this point the main guide lines of the financial plan have emerged. The approximate amount of money which will be required to finance the needed public works is known, and a rough timetable of when the money must be available is possible. The proportion of the necessary funds to be raised by the sale of new bonds has been determined, and the plans for servicing the debt have been developed. In some cases the new levies will have already been made. The method of financing (GO or revenue bonds) has been decided for each type of project. The broad plan for debt retirement has been developed. Policy decisions which seem reasonable when viewed separately often may take on quite a different appearance when surveyed as a part of what should be an integrated plan. Very often additional adjustments must be made to arrive at an integrated financial plan. Because of the conflicting goals, differences of opinion are to be expected. The most promising method of resolving these differences is open public discussion with every effort made to eliminate the emotional overtones.

Two Illustrations

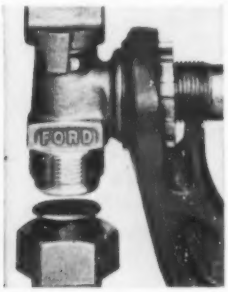
In a period of expansion, particularly during the accelerating phase, a conservative outlook and a discussion of careful financial planning seems terribly out of tune with the times; but when an economic reaction sets in the problems of finance appear in a different setting. It seems appropriate therefore to conclude this article with two illustrations of communities, located rather close together, which grew very rapidly in the 1920's. Both areas have great natural advantages, both were in need of additional capital improvements, but here the similarity stops. Community "A" proceeded slowly, put in improvements only as needed and economized wherever feasible. The financing was generally along sound lines, although more attention could have been given to flexibility as the bonds were noncallable and it was later not possible to use a cash surplus to reduce the debt. Community "B" on the other hand 'built for the future,' and it was a bright future which was envisaged. The new public buildings were expansive with emphasis upon striking exteriors. Utilities and streets were installed over a wide acreage. The financing was entirely without plan, a fact about which the critics made some very unkind remarks.

The section of the nation where these communities are located was very hard hit by the depression. However, in community "A" the county, city and school district all met their obligations promptly. The possibility that any other course was possible seems never to have occurred to the officials. In community "B" a very different record was made. The county, city and school district defaulted early in the depression. Later there were defaults on the forced refunding bonds. In spite of the great natural advantages this community has had one financial crisis after another.

can YOUR water meters be installed with one hand . . . in 9 seconds?

NOW . . . low-cost Ford yokes make possible new standards of speed and simplicity in meter setting or removal

The Ford yoke shown above can make water meter installation a lightning-quick operation for your maintenance crews . . . cut meter installation time and cost.



Improved Valve, which can be provided as part of Yoke, does away with loose connecting ring, includes standard copper tube nut. Result is easy-to-make, leak-proof joint.

Here's how: With the Ford yoke holding inlet and outlet piping in fixed position (see photo), the meter is 1) simply set in place on the yoke, and 2) made water-tight by a manual expansion connection. The complete job takes only 9 seconds! Yet, speed isn't the only advantage of a Ford yoke. Equally important: Subsequent meter changes need never disturb service line spacing or alignment, eliminating a frequent source of trouble and leaks.

Millions of Ford yokes are in service all over the nation and Latin America . . . proving every day that there is almost no installation that can't be made better with a Ford yoke. Find out now how much maintenance time and money these low-cost units can save you.

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New microfilm reader with magazine-loading!

By far the easiest and fastest to use!

Another first from Recordak—the new Lodestar Reader with magazine loading! This remarkable microfilm reader introduces an entirely new concept in reference work. Cuts "look-up" time from minutes to seconds! *And so easy*—just slip the microfilm magazine into the reader-slot and the Lodestar turns on automatically. No threading! No adjustments! No waiting! Hands never touch film.

Fast as the Lodestar advances your film (at speeds up to 600 ft. per minute), the code lines are easy to follow . . . lead you right to the pictures you want. One large user, with hundreds of Lodestars in branches, reports that this new reader lets them find any item in 32,500 pages of parts data in 20 seconds or less!

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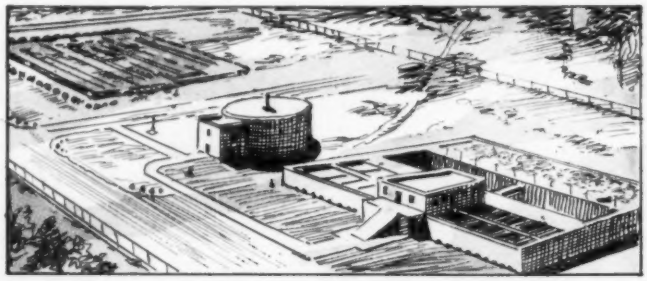
THE SEWERAGE AND REFUSE DIGEST



Prepared by **ALVIN R. JACOBSON, Ph.D**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

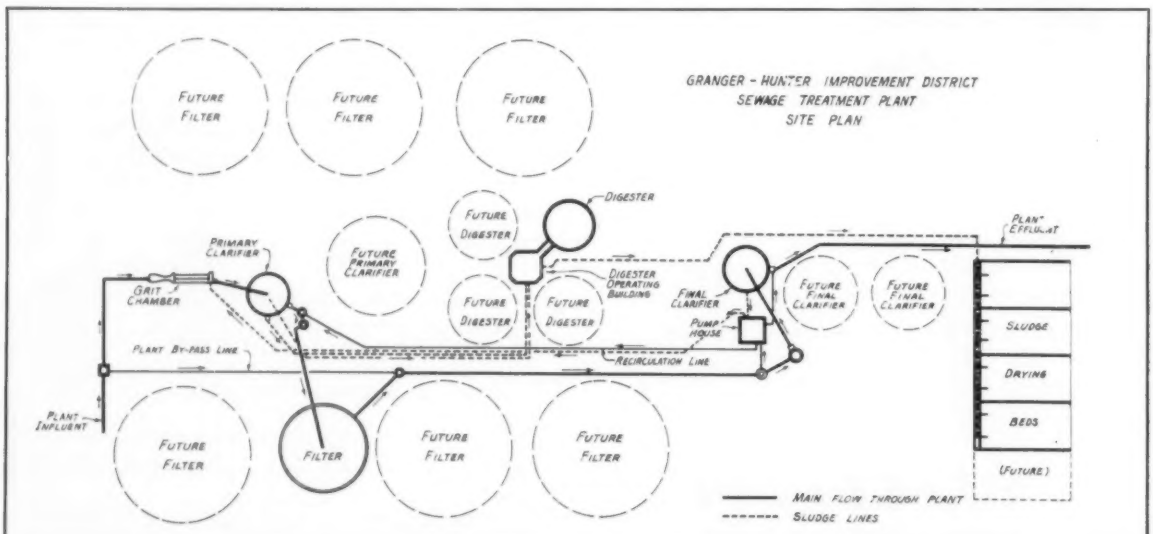
Higher Filter Loadings

In order to solve the sewage treatment problems in Corpus Christi, Texas, brought about by a rapid increase in population, it was necessary to increase the capacity of the Broadway plant by the use of higher loading. This plant located in the downtown area of the city was increased from 11 to 17 mgd without adding acreage and by utilizing existing clarifiers, filters and sludge treatment facilities. The present plant, completed in February, 1957, has three primary clarifiers, two roughing filters, two final clarifiers, an intermediate pump station, final stage pumps, four standard rate filters and a sludge filtering and drying plant. Nearby sludge drying beds were retained for emergency use. The roughing filters with no recirculation provide a 56 percent BOD reduction. These filters may be bypassed, permitting the flow directly to the standard filters with recirculation through them. Filters are operated at standard rates at present with recirculation increased during night-time flows. They will be operated at increased loading up to high rate standards as needed. The sludge digesters are heated to operate at 105° F for thermophilic bacterial decomposition which doubles their capacity. Treated sludge is vacuum filtered, the cake dehydrated in a rotary dryer, ground and screened, after which it is bagged and sold as fertilizer.

"High Filter Loading Solves Sewage Treatment Problems." PUBLIC WORKS, March, 1959.

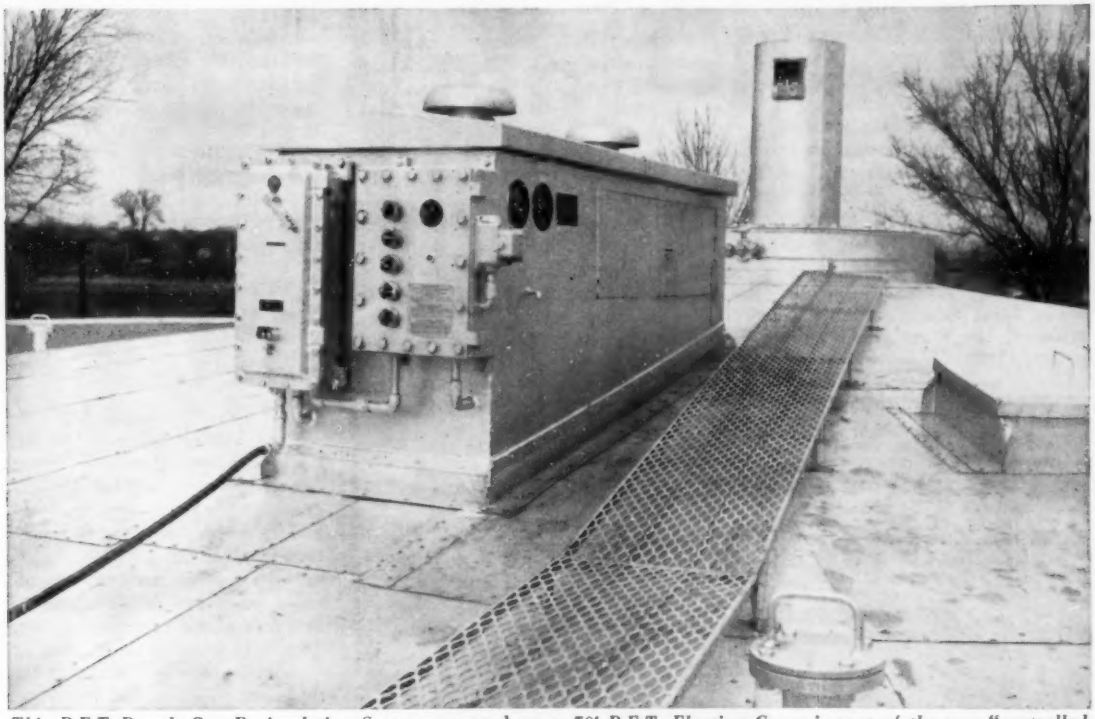
Joint Sewage Treatment Plants

In this article the author relates the experience of two sewer districts, planned and financed under Utah law, to bring the benefits of sewer systems and adequate sewage treatment plants to formerly rural areas which have become highly urbanized. In 1954 the North Davis County Sewer District was created encompassing some 50,000 acres and 8 communities. The previously organized North Davis Metropolitan Sewer Association transferred all its assets to the new sewer district. In 1955, a bond election was held and the voters overwhelmingly authorized issuance of $2,100,000 general obligation bonds and $800,000 of revenue bonds, to provide additional outfall mains to serve new areas, to relieve existing overloaded sewers and to construct a two-stage high-rate sewage treatment plant. A $150 charge per house connection and a monthly service charge of $1 per residential connection is levied. The Granger-Hunter Improvement District was created in 1950 for the purpose of constructing and operating systems to supply and distribute water and collect, treat and dispose of sewage in Salt Lake County. A bond election in 1956, authorized the issuance of $400,000 in general



Courtesy Wastes Engineering

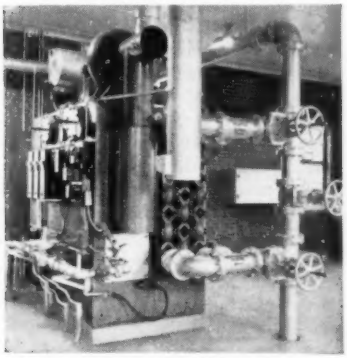
● **TREATMENT plant for two districts is designed for 15,000 with units spaced for expansion to serve up to 100,000 people.**



This P.F.T.-Pearth Gas Recirculation System mounted on a 70′ P.F.T. Floating Cover is part of the new "controlled digestion" system just added to the Decatur, Illinois sewage treatment plant. Design of plant by Warren & Van Praag, Consulting Engineers, Decatur.

Decatur, Illinois installs complete modern P.F.T. "Controlled Digestion" system

Unusual industrial and population growth has called for the modernization and expansion of Decatur's sewage treament plant three times in recent years. Each time Decatur has selected P.F.T. equipment.



Decatur's new P.F.T. No. 750 Gas Fired Heater and Heat Exchanger, with accessory group B, controls, provides full automatic digester temperature control.

The P.F.T. equipment furnished for the most recent expansion is a new digestion system which includes: a 70′ P.F.T. Floating Cover with prefabricated aluminum roofing; the P.F.T.-Pearth gas recirculation system and Model 750 Digestion Heater and Heat Exchanger shown; plus a complete new system of gas piping with P.F.T. gas safety equipment.

The P.F.T.-Pearth gas recirculation system includes a gas compressor rated to deliver 150 cfm at 10 psi powered with a 10 hp motor. Controls are provided to automatically discharge to each of 4 peripheral discharge wells in sequence.

The wells are equally spaced around the cover extending to a depth of approximately 10 feet below the liquid level in the tank. The compressor and low and high pressure bypass controls are mounted on the floating cover in an insulated housing.

P.F.T.-Pearth gas recirculation provides the most effective means of controlling scum formations. This allows the use of the full Digester capacity. Combined with close temperature control with a P.F.T. Heater, rapid and complete digestion is assured. Decatur's new "controlled digestion" system is now geared to meet the needs of this fast growing community.

Waste Treatment Equipment
Exclusively since 1893

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obligation bonds and $1,500,000 in water-sewer revenue bonds. Regulations provide for a $150 connection fee charge and $3 per month service charge for sewer service. The high-rate filter sewage treatment plant is provided with final clarification and chlorination and is designed for a population of 15,000 with units spaced to permit expansion of the plant to serve 100,000 population. This plant is shown in the accompanying figure.

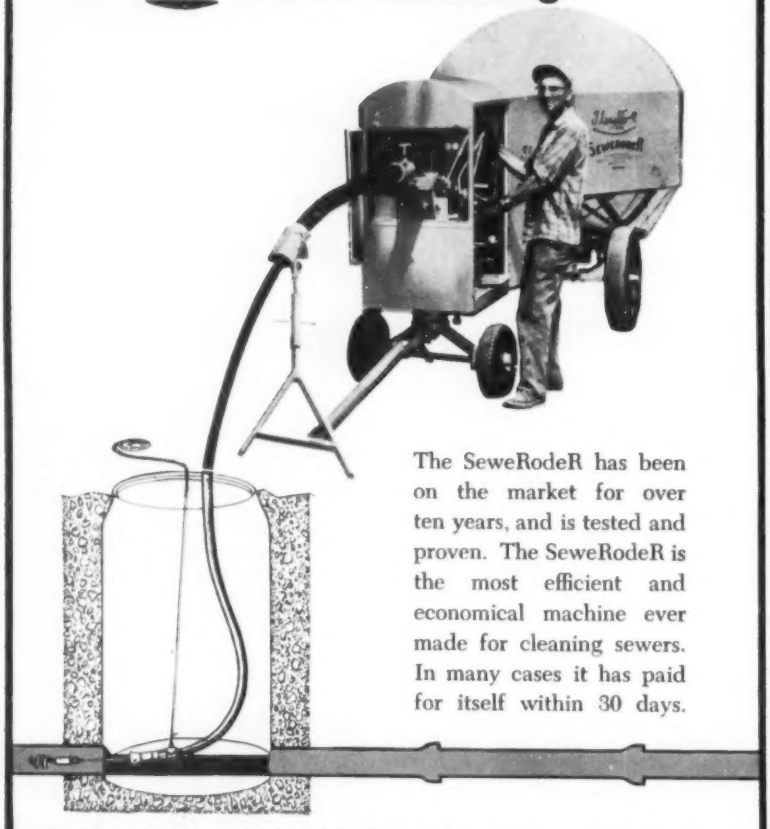
"Cities Join Mutual Districts to Provide Joint Sewage Plants." By Win Templeton. *Wastes Engineering*, February, 1959.

Pure Enough

Fairfax, Va.'s sewage treatment plant purifies its sewage sufficiently before discharge of its effluent into the Accotink Creek to offer no danger to the health of the Army's Engineer Corps Center at Fort Belvoir which obtains its water supply from this source. The plant, designed for an average flow of 2.0 mgd, consists of two-stage biofiltration, pre-aeration of the raw sewage, post-aeration of the effluent from the final clarifiers and disinfection. The plant design was based on a raw sewage of 300 mg/L BOD and a final effluent of 10 mg/L or less BOD. Digested sludge is dewatered on a vacuum filter and transported to a sanitary landfill for disposal. The total cost including engineering, inspection and interest during construction came to $994,855. Financing was by $1,000,000 general obligation bonds which are being paid off by revenues from sewer connection and service charges.

"Pure Enough for the Military." By Glenn W. Saunders, Jr. *The American City*, February, 1959.

The SeweRodeR is preferred for all sewer cleaning!



The SeweRodeR has been on the market for over ten years, and is tested and proven. The SeweRodeR is the most efficient and economical machine ever made for cleaning sewers. In many cases it has paid for itself within 30 days.

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Diffuser Clogging

Fine bubble diffusion of air into sewage is very desirable in providing added total liquid-gas interfacial area for oxygen transfer, and the smaller bubbles rise more slowly through the liquid; however, maximum use of the process has not always been possible because of the problem of diffuser media clogging. The author presents in this article the details of a laboratory study undertaken to study the problem. Various causes of clogging, both external and internal, were investigated including the effect of iron salts, calcium bicarbonate hardness, fine sand in the liquid, and the effects of particulate matter and humidity in the air supply. The author concludes that particulate matter in the air supply has caused more media clogging in operating plants than any other single cause. It is proportional to the quantity of the particulate matter and also to the humidity in the air supply. Bag filters precoated with asbestos "floats" will supply air with not more than 0.1 mg of particulate matter per 1,000 cu. ft. of air. Ferrous iron is an undesirable material in incoming sewage and does not belong in a public sewer since it interferes with efficient plant operation. Excessive calcium bicarbonate is also found troublesome in some cities. The use of humidification and truly clean air may offer a solution to this type of clogging which has been a problem in many cities.

"Clogging Studies of Fine Bubble Diffuser Media." By Philip F. Morgan. *Sewage and Industrial Wastes*, February, 1959.

Custom-Designed Incinerator

The low, flat terrain of the Southeast Florida coastal area at Hollywood, Florida dictated construction

Landfill and Cloroben go together !!!!!!!!!

MORE and more popular, landfills are proving an economical means of creating park and recreational areas, parking space, and even building sites. The operation of sanitary landfills is simple and inexpensive. No construction is required. And, by proper application of Cloroben, nuisances can be effectively controlled.

All that is required for a successful landfill operation is the reasonably close proximity to the community of areas to be filled and reclaimed as long haulage of refuse is uneconomical.

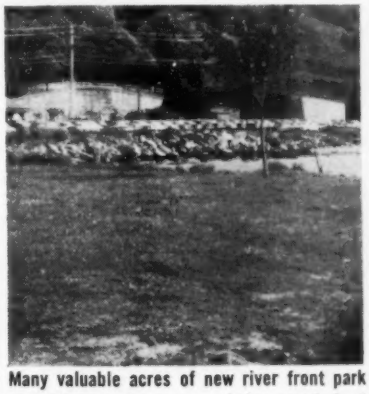
CLOROBEN PROVES EXCELLENT IN BOTH THESE METHODS OF LANDFILL OPERATION

1. THE OPEN DUMP. Most suitable for low lying uneven territory which may be part dry and part swamp land. Refuse is dumped, spread, then compacted by bull dozer. For each three feet of refuse, about one foot of dirt coverage is made. While refuse is being compacted, a Cloroben spray is effective in the control of odors and all types of insect pests.

2. THE RAISED DUMP. Along the banks of rivers, streams, or where there is a definite drop in land level. The refuse is dumped on a slope. It is then compacted and covered by soil pushed over the refuse from above. Generally practised along shore lines, edges of swamps, this type of operation particularly needs Cloroben applications.

If your community is now in the process of a landfill operation, or contemplates one, certainly "Cloroben Landfill and Refuse Spray" is worth your immediate attention. The most effective odor control measure! Highly efficient for the control of insects and larvae.

Refuse being sprayed with Cloroben at landfill operation; Dobbs Ferry, New York.



Many valuable acres of new river front park and playground area are being created at Dobbs Ferry the safe sanitary way with Cloroben refuse spray.

Chris E. Olsen famous entomologist of the American Museum of Natural History (retired), confirms remarkable effectiveness of Cloroben in killing insects and larvae, stating: "Cloroben killed insects of all species sprayed with dilutions varying from 1 to 5%".

Bart Paino, Supervisor of the Dobbs Ferry operation states: "1% solution of Cloroben eliminated odor complaints entirely. Insect nuisance cut 80%."

YOURS ON REQUEST: Authoritative manuals now being prepared will be sent giving specific details and methods for the use of Cloroben in various types of landfill operations.

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of a two-story incinerator to enable direct charging of refuse. This new structure, designed to burn 450 tons per 24 hours, has several cost-saving features including an outdoor-type plant, low stocks, direct charging facilities and provisions for the future inclusion of special scrap-handling equipment should the price of scrap rise sufficiently to make it economically feasible. A 75-ton storage bin with clamshell is provided for temporary storage of refuse during peak periods. Each of the rectangular furnaces are provided with an oscillating type grate and an expansion chamber. The furnace temperature is normally held at 1800° F. and excess air is admitted below fire in three zones through cast iron tuyeres. As they pass through the expansion chamber, the burning gases are split, half being forced around each side of the stack. They then pass through a baffle port before entering the stack. Fly ash emission from the stacks is visibly low and the smoke nearly perfectly white. The average of three tests made on the furnace discharge gases showed a solids content of 0.062 grains per cubic foot and 0.098 grains per cubic foot on the two units, corrected to 12% CO_2. An equipment storage and maintenance compound was constructed adjacent to the incincerator to provide more efficient operation. A time and motion study indicated an annual savings of $37,000 would result from this centralization of all Sanitation Department equipment and personnel.

"A Custom-Designed Incinerator." By J. W. Watson. *The American City*, February, 1959.

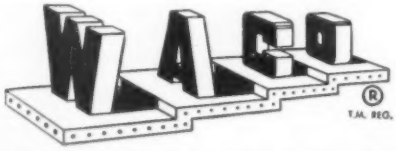
Economical Sewage Treatment

One of the smallest and most unusual operating sewage treatment plants, incorporating complete treatment, has been constructed at Delray Beach, Fla. to serve 215 homes with a population of 750 people. The sewage is delivered to the primary sedimentation tank from a pumping station. Primary sedimentation is accomplished in a hopper bottom tank 16 x 10 x 8.5 ft. The design flow, including recirculation, is 116,000 gpd providing a detention period of 1.86 hours with surface loading of 727 gpd per square foot and an overflow rate of 11,600 gpd per foot of weir. Sludge is removed by gravity to a sludge inspection box, from which it is pumped to an unheated and uncovered digester. Supernatant is discharged from any one of three selection points to a recirculation pit and returned to plant influent. Sludge can be recirculated through the sludge inspection box. No sludge drying beds were provided at the time of construction. Effluent from the primary clarifier is pumped to a conical bottom tank feeding a fixed nozzle distributing system to dose sewage on a trickling filter. The effluent flows into the secondary sedimentation tank located directly below having a 2.30 hours detention period. The final effluent is chlorinated. Costs on this plant were reduced partially through construction of concrete blocks and stucco and minimum use of equipment. Similar plants have shown an overall plant efficiency based on suspended solids removal of 84% and an 87% BOD reduction.

"Economical Sewage Treatment Plant." By J. W. Greenleaf. *Water and Sewage Works*, February, 1959.

Variable Treatment

A flexible custom-built sewage treatment plant has been designed for Logansport, Ind., in which river flows and oxygen balance will dictate the use of either primary or secondary treatment and effluent chlorination in order to meet the



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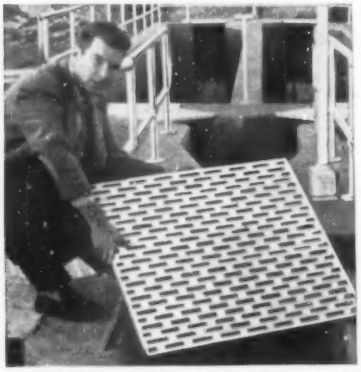

George H. Hill, Washington Aluminum's New England representative, points out the grating's patented perforation pattern.

Washington Aluminum Walkways *proride* a lifetime of maintenance-free service — never need painting, resist rust and corrosion, provide ventilation. Their strength lies in the I-beam extrusion.

Washington Aluminum fabricates grating and other installations to specification. Consult our Engineers at point of planning. . . . No charge — no obligation! . . . an engineering service of Washington Aluminum Company, Inc.

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— by requiring only a quick hosing off of the float once in many weeks — nothing more. Receiver may be located as much as 5000 feet from transmitter.

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Think of the savings!

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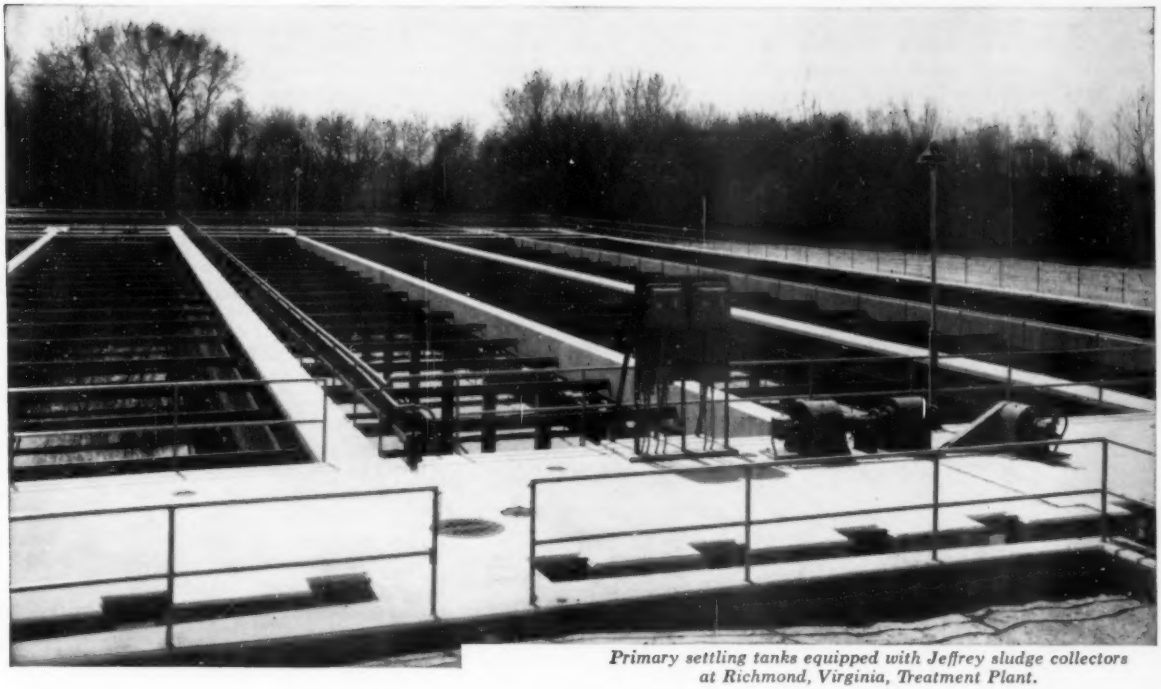
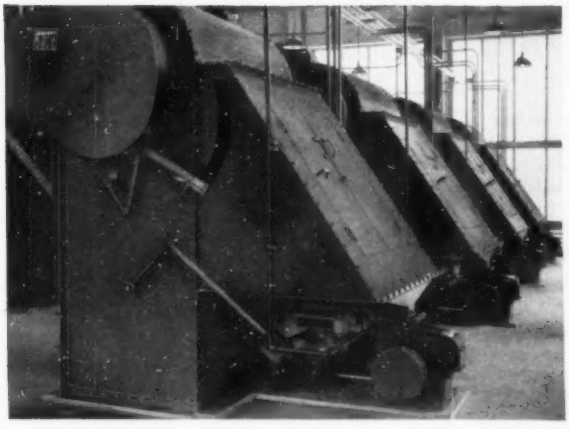


Primary settling tanks equipped with Jeffrey sludge collectors at Richmond, Virginia, Treatment Plant.

New waste treatment plant prepares Richmond for 2000 A.D.



Jeffrey mechanically cleaned bar screens with screenings grinders at Richmond plant. Grit is received from V-bucket type collectors, and washed by Jigrit washer.

Can a treatment plant, operating at optimum efficiency in 1958, be just as efficient in 2000 A.D.? The City of Richmond, Virginia, thinks it can:

Their new Jeffrey-equipped primary treatment plant satisfies current needs with a dry weather flow of 28 mgd. As designed by consultants, Greeley and Hansen, the plant may be easily converted to 126 mgd. secondary treatment, based on a population of 554,000 by the year 2000. Thus an intelligent, long-range plan provides Richmond with a system geared for today, yet fully adaptable to the more-than-double capacity needed for tomorrow.

Jeffrey's line of treatment plant equipment includes bar, disc and traveling water screens, grinders, collectors, washers, scum removers, feeders and FLOCTROL (controlled flocculation). Catalog 905 describes this and other equipment for water, sewage and industrial waste treatment. The Jeffrey Manufacturing Company, 947 North Fourth Street, Columbus 16, Ohio.

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following requirements of the Indiana Stream Pollution Control Board: "Dissolved oxygen concentration at the critical point in the receiving streams shall be no less than 50 percent of saturation at design loads, during minimum 7-day, 10-year frequency flows." This plant will match the dissolved oxygen requirements in the Wabash River by varying the BOD in the effluent as the stream flow ranges from over 1,000 cfs to as low as 160 cfs. During high flows the plant will provide primary treatment only; effluent chlorination will be added during intermediate flows. A design was developed for diversion of a portion of the primary effluent to aeration tanks for activated sludge treatment during low flows. This will achieve treatment efficiencies over and above that afforded by primary treatment alone. The disposal of digested sludge is accomplished economically and successfully by transportation to farm land by means of a 1,500 gal. tank truck, with the exception of periods of wet weather. Vacuum filtration equipment was provided as a means of disposal during periods when trucks cannot be operated. Several other interesting design features have been provided in this new plant costing approximately $1,000,000.

"Three Types of Treatment Will Vary Quality of Plant Effluent." By G. K. Erganian and C. F. Niles. *Wastes Engineering*, February, 1959.

Lagoon Performance

Three lagoon installations have been studied by the Melbourne and Metropolitan Board of Works Research Laboratory, Melbourne, Australia. This paper reviews the performance of these lagoons and shows that the process may be relied on to give satisfactory treatment when used for any of four different purposes: a) To complete the treatment of trickling filter effluents; b) to complete the treatment of land-treatment effluents; c) to give complete treatment to normal strength sewage; and d) to give complete treatment to weak, storm-flow sewage. One lagoon consists of anaerobic and aerobic units in series, with the aerobic area three times the anaerobic area. The second lagoon consists of an aerobic lagoon of about 550 acres preceded by anaerobic units with an aerobic-anaerobic ratio of about 5 to 1, depending on the units in operation. The third lagoon consists essentially of aerobic units treating effluents from a trickling filter plant. Over 98 percent of the sewage of Melbourne (77 mgd) is purified by irrigation, grass filtration, and lagoon treatment at the 27,000-acre Metropolitan farm 24 miles from Melbourne. The author has discussed the operating characteristics, the problems encountered, and the results obtained under different operating and seasonal conditions. Several diagrams of lagoon layouts add considerably to this discussion.

"Performance of Large Sewage Lagoons at Melbourne, Australia." By C. D. Parker, H. L. Jones, and N. C. Greene. *Sewage and Industrial Wastes*, February, 1959.

Other Articles

"Coefficients for the **Solution of Manning's Formula.**" A table of coefficients that have proved convenient in the design of circular sewers. By T. N. Kapoustine, Public Works, March, 1959.

"Sewage Pumping Stations Built Below River Level." A description of **pumping and sewage plant installations** at Oil City and Warren, Pa. on the Allegheny River. Public Works, March, 1959.

"Industrial Utilization of Municipal Wastewater." A study of present usage and recommendation that this source be given wider consideration by industry. By C. H. Connell and E. J. M. Berg. Sewage and Industrial Wastes. February, 1959.

Pulling RABBITS out of a HAT

It is obvious that water rates should be sufficient to finance maintenance, operations and necessary new construction. But water rates in America have been too low for over 75 years. The average paid by American water consumers for all water used is a little over 2 cents per day or 5 cents per ton. Water is the cheapest necessity you buy.

There are now many water distribution systems too small to supply peak demands of the growing communities they service, because they have been unable to finance new construction out of revenue. With a 65 to 70% potential increase in water consumption now predicted by 1975, the problem daily becomes more serious and water works improvements and extensions are needed on an increasing scale.

A magician may really appear to pull a rabbit out of his hat. But you can not expect your water works Superintendent to secure in that manner increased water supply, treatment, and distribution. To serve you better, he needs your help.

This Series is an attempt to put into words some appreciation of the water works men of the United States.

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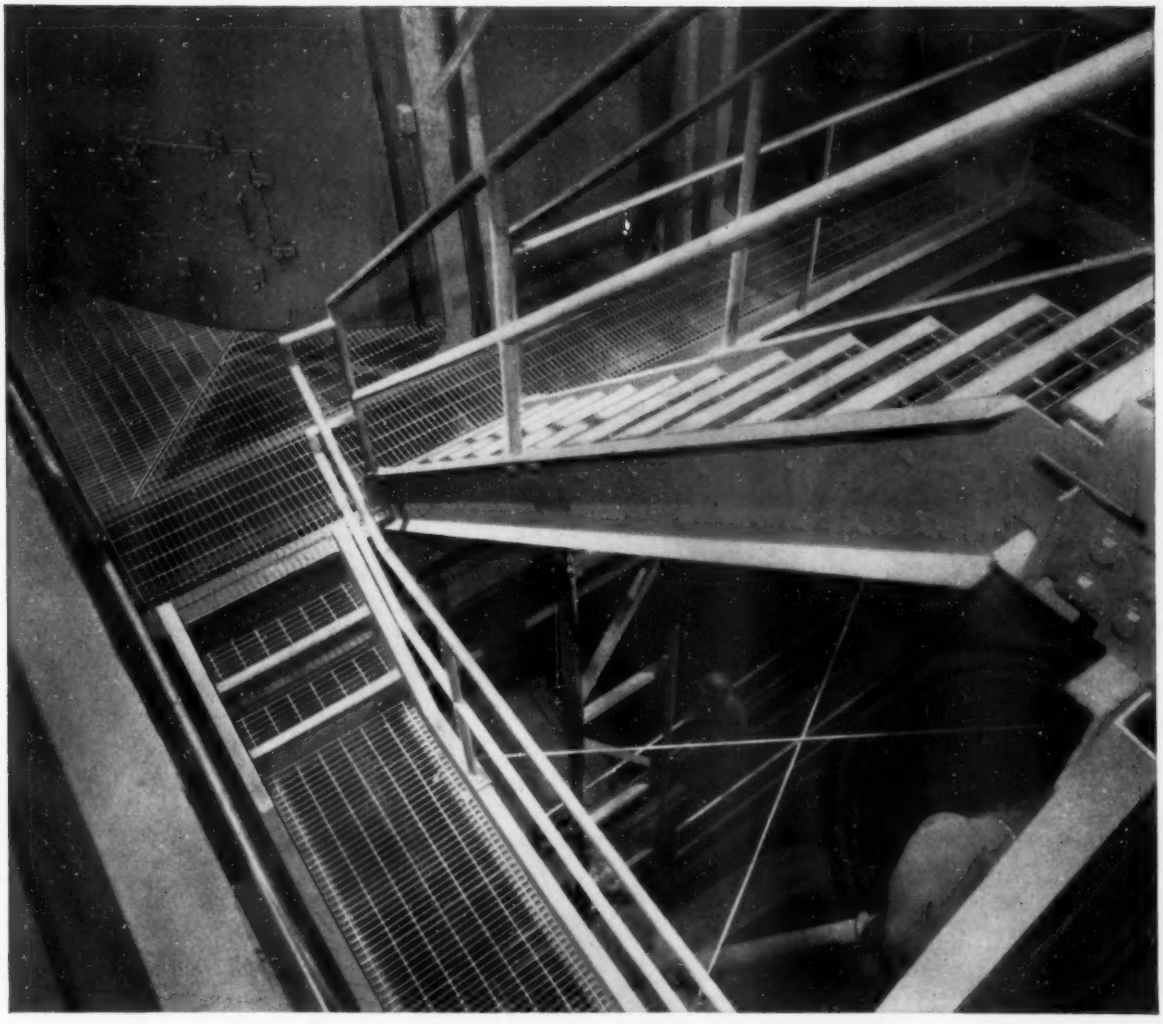

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Because it's open . . . because air and light can pass through and dust can filter down, cement manufacturers insist on floors and stairways of Blaw-Knox Electroforged Steel Grating.

Easily installed around pipes and machinery without altering the building, Blaw-Knox Electroforged Steel Grating provides a safe, non-slip walking surface that does not collect dirt or grease. Each section is of one-piece construction... no rivets or bolts to clog openings.

One-piece construction also adds to structural strength and load-bearing capacity. As the bars are forged together, rather than slotted, the metal is not weakened in any way.

Blaw-Knox Electroforged Steel Grating and Treads are fabricated to your specifications to meet your own operating conditions. For information on how to specify and order grating, write for Blaw-Knox Bulletin No. 2527.

BLAW-KNOX

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Blaw-Knox Equipment Division
Department W, Pittsburgh 38, Pennsylvania

"A Method of **Starting High-Rate Digesters.**" A report of a method of initiating sludge digestion with raw sewage alone in high-rate digesters without seeding. By E. Alan Cassell and Clair N. Sawyer. Sewage and Industrial Wastes, February, 1959.

"Metal Media Vacuum Filters for Sludge Dewatering." Recirculation of sludge in the secondary digester and the use of reclaimed lime from the Dayton, Ohio, water treatment plant have aided in the **sludge dewatering process** and at a reduction in chemical cost. By K. B. Singleton. Water and Sewage Works, February, 1959.

"Catch Basin and Sewer Cleaning." The author discusses some of the elements responsible for the high cost of operating and maintaining sewer systems. By Howard A. Biggs. Public Works, March, 1959.

● ● ●

Sludge Gas Production and Value

Gas produced at the Gary, Ind., sewage treatment plant during 1957 averaged 1.08 cu. ft. per capita per day; 2.08 cu. ft. per pound of solids added to the digesters; and 3.81 cu. ft. per pound of volatile solids added. The value of the gas used for plant power during the year amounted to $17,081. The plant served an estimated 147,500 population with an average daily sewage flow of 27.92 million gallons. Cost of operation was $19.51 per million gallons or $1.35 per capita, not including bond interest and retirement. Raw sewage BOD averaged 219.6 mg/L; final effluent averaged 19.2 mg/L.

Statistics Show Trend Toward Secondary Treatment of Sewage

There were more than 76 million persons in the United States in cities served by 7,518 sewage treatment plants in 1957, and almost 57 percent of the plants used secondary treatment. These figures and complete statistics on sewage treatment are reported in Publication 609 of the Public Health Service's Water Supply and Water Pollution Program entitled, "Statistical Summary of Sewage Works in the United States," by John R. Thoman and Kenneth H. Jenkins.

Since 1945, the population represented by the cities having secondary treatment has doubled, and the number of secondary treatment plants has increased by two-thirds. There have been a significant decrease since 1949 of plants having less than secondary treatment and a substantial decrease in the population in cities served by plants not having at least sedimentation facilities since 1945.

In the Western Gulf basin, treatment plants having secondary treatment served almost 97 percent of the population with sewer connections, compared with less than 23 percent so served in the Northeast basin. The Missouri River basin has the highest percentage of population in cities having intermediate treatment, while the Pacific Northwest basin reports the greatest percentage served by primary treatment. There appears to be some correlation between the degree of treatment and the degree of industrialization. There is possible correlation, also, with population density or degree of urbanization.

In 1957 there were 2,730 primary treatment plants in the United States serving a population of about 26 million. Imhoff plants are the most numerous type, comprising almost 40 percent of all primary plants. In 1945, 83.5 percent of the primary plants were of the Imhoff or septic tank type and these served 36.0 percent of the population. In 1957 these percentages had declined to 68.3 and 16.8 percent, respectively. While the number of Imhoff tank plants increased from 1945 to 1957, there was a 31.2 percent de-

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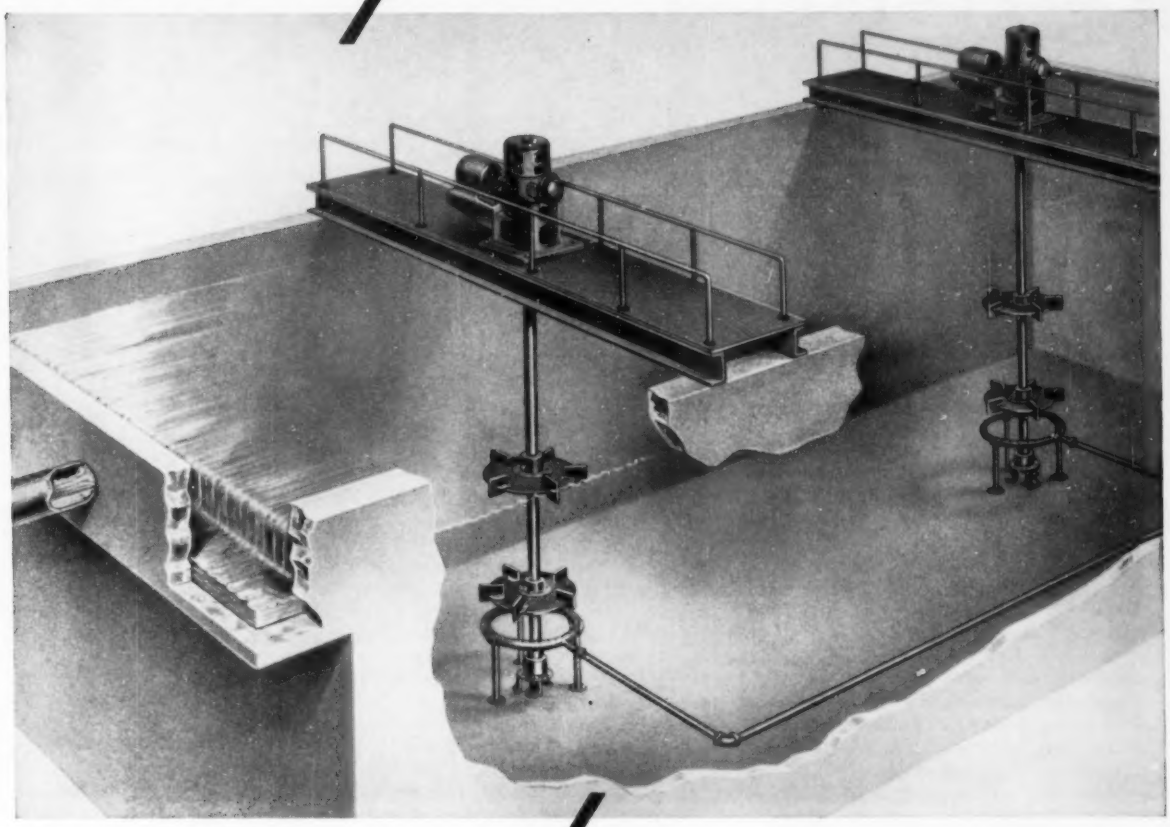

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- reduces sludge clogging
- cuts plant costs

Higher effective oxygen utilization – up to 50% compared with 5 to 6% in conventional systems – enables the new D-O Aerator to meet increased demands of the more concentrated activated sludges in today's biological sewage processes.

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What's more, overall installed costs are lower than those of conventional units. The new D-O Aerator can be adapted to a variety of tank sizes and installed in existing tanks. For more information write to Dorr-Oliver Incorporated, Stamford, Conn.

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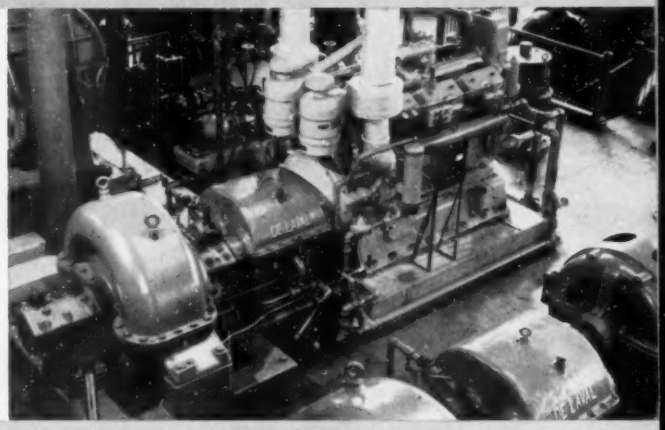
Caterpillar Spark-Ignition sewage aerating Engines use "free" fuel in Peoria disposal plant

Exterior view, showing aeration tanks (foreground) at activated-sludge-type disposal plant with separate sludge digestion works. The sewage gas, generated by digestion, provides 600 BTU per cu. ft. high heat value, and "free" fuel for the Caterpillar Spark-Ignition Engines.



A Caterpillar D397 Spark-Ignition Engine drives a DeLaval centrifugal blower while another Caterpillar Spark-Ignition Engine drives a Connersville blower. This sewage plant provides service for an actual population of 130,000 but which equals an equivalent population of 275,000 due to industries.

There are no fuel costs for the two Caterpillar Spark-Ignition Engines which pump air into sewage aeration tanks at the Peoria, Illinois, disposal plant. They use sewer gas, created by digestion, as their fuel.

One of the two engines operates around the clock, throughout the year, with shutdowns for maintenance only. In 17,000 hours of operation, it needed only normal maintenance. On the basis of this engine's performance, a Cat D397 Engine was selected to provide additional capacity. It operates 4 peak-load days a week and acts as standby.

If the methane type gas generated in your disposal processes has high enough heat value, you too can get "free" fuel. And you can cut maintenance costs and reduce the risk of down time. Get the facts on Caterpillar Spark-Ignition Engines. There are many to get—and they'll all save you money. Write for your free copy of "Caterpillar Spark-Ignition Engines."

Engine Division, Caterpillar Tractor Co., Peoria, Illinois, U.S.A. Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

Each of the three Caterpillar Spark-Ignition Engines comes in 7.5:1 and 10:1 compression ratios. The lower ratio is for operation on butane and propane gases. The 10:1 ratio is for methane-type operation.

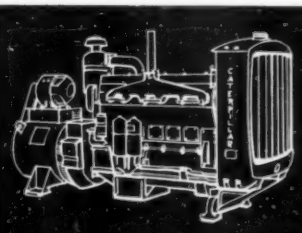
CDES stands for Caterpillar Diesel Engine Specialist, your engine power consultant. He'll help you select the right equipment, aid on installation, counsel with you whenever you wish.

Caterpillar Diesel Engines and Electric Sets are available for your installations—in disposal plants, water works, electric utilities—as primary or stand-by power.

3 Caterpillar Spark-Ignition Engines to choose from —each with more power in less space
Ratings for Continuous Operation w/o Fan

	7.5:1 Compression Ratio	10:1 Compression Ratio
D342—1200 RPM	200 BHP	225 BHP
D375—1300 RPM	275 BHP	310 BHP
D397—1300 RPM	415 BHP	470 BHP

CDES



crease In the population served. The corresponding decrease for septic tank plants was 25.5 percent.

The increase in construction of mechanically cleaned tank primary plants was substantial. They now are used in almost one-fourth of all primary plants, but serve 72.7 percent of the overall population. From 1945 to 1957 they increased over 84 percent in numbers and 95.1 percent in population served.

In general, septic tank and Imhoff tank plants predominate in the smaller population groups, with mechanically cleaned tank plants coming into major use in the communities of over 5,000 population. In the Pacific Northwest basin over 93 percent of the population with sewer connections and served by primary treatment are in cities having plants with mechanically cleaned tanks. The corresponding figure is only 4.4 percent in the Western Gulf basin.

The population served by 4,747 intermediate and secondary treatment plants is almost 49 million. The activated sludge process is used in 589 plants serving 24.8 million persons—over 57 percent of the total population in cities having secondary treatment. Trickling filters, both standard and high rate, total 2,682 plants and serve over 15 million persons. Intermediate treatment is defined as chemical treatment with sedimentation in the absence of any secondary process. There are 100 such plants serving 5.6 million persons.

The activated sludge process predominates in cities over 25,000 in population; standard rate trickling filters in communities under this size. The use of oxidation ponds is a major item in communities with populations less than 500.

In the Lake Erie basin, almost 55 percent of the plants are of the activated sludge type while in the Colorado River basin only 5.2 percent are reported. In this latter basin, 43.7 percent of the plants have oxidation ponds. Sand filters continue to be a major plant type only in the Northeast basin. High-rate trickling filters are used in 52.7 percent of the plants in the Pacific Northwest basin.

The population served by the activated sludge process increased from 11.6 to 25.0 million during the 1945-47 period. This represents the largest increase. The greatest percentage increase during this period was for oxidation ponds. The number of plants increased from 45 to 631, and the population served increased from 0.2 to 2.4 million.

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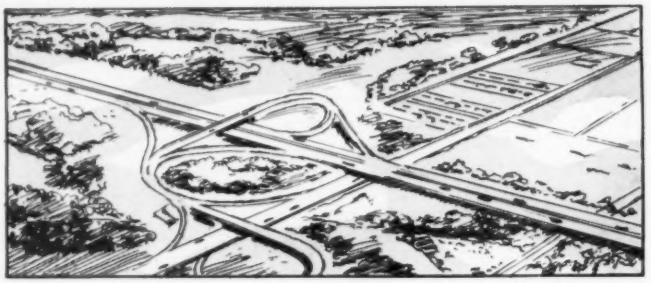


Prepared by **FRANK FORCE,** *Associate Editor*

Precast Bridge Units for Smaller Structures

For short-span bridges on the primary and secondary road systems in New Mexico, the department prepared the following standard plans: Precast concrete deck units for 25-ft. and 31-ft. span lengths whose members are inverted channel sections 3 ft. wide and reinforced with standard reinforcing bars; and precast concrete girders for 40-ft. spans where the members are rectangular in section 10 ins. wide by 40 ins. deep and conventionally reinforced. For grade separation structures in the interchanges of the Interstate System, standard plans are used for bridge decks with conventionally reinforced precast concrete girders of a modified I section in span lengths from 36 ft. to 73 ft. Various types of cast-in-place concrete structures are being designed and built; these include short-span continuous reinforced concrete slab bridges for drainage crossings, and modified box girder construction for longer spans in grade separation structures. The continuous rolled steel beam span bridges with concrete deck cost an average of $12.63 per sq. ft. in 1958 lettings. In 1958 the average cost of precast concrete bridges was $11.28 per sq. ft. The pretensioned concrete bridges cost an average of $11.08 per sq. ft. For railings, bids are taken on both steel and aluminum.

"New Mexico's Bridge Design Trend." By W. E. Strohm, Bridge Engineer, New Mexico State Highway Dept. *Roads and Streets*, February, 1959.

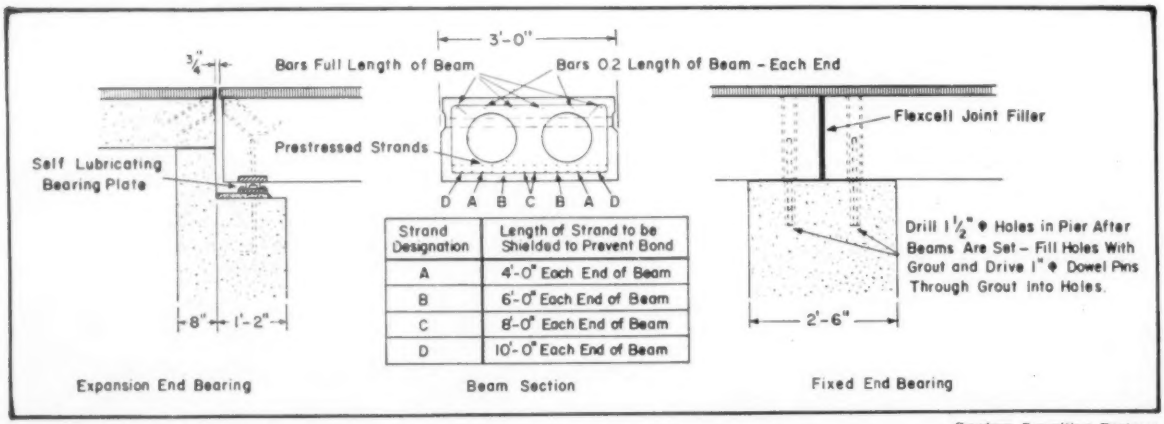
Roadside Rests Increase Travel Pleasure

Ohio has 273 roadside rests open to the traveling public on their state highway systems. Location, purchase and building of parks are now under general highway construction on the Interstate Highway System. The following points of a directive issued by the Highway Director on roadside rests are: A) Rest areas will be included in the design of Interstate Projects; B) Areas shall be normally located at intervals of approximately 25 miles on each side of the highway; C) Selection of the areas shall be made promptly after the roadway line and grade has been established; D) Geometric features shall follow a set pattern; and E) Plans shall be submitted by the landscape architect. In the selection of the site the following steps are taken: Aerial survey; character of the site; and spacing of the sites. Design of the areas follow this pattern: Traffic features; rest area facilities for convenience and comfort; grass areas; and planted areas. In considering the combination of rest areas with other facilities, police and maintenance structures, gasoline service stations and eating plazas are considered. When rest areas are to be constructed on the general contract, purchase of right-of-way and change orders are handled. Past experiences of rest areas that have proved satisfactory and ones that have not are taken into consideration in the design. Future trends in rest area design and maintenance which may be affected by increased traffic and change in adjacent land use are also considered.

"Ohio's Roadside Rests Increase Travel Pleasure." By Wilbur J. Garmhausen, Chief Landscape Architect, Ohio Dept. of Highways. PUBLIC WORKS, March, 1959.

Designing Small Span Bridges

Individually designed and constructed small span prestressed concrete bridges can be built economi-


3'-0"
3/4"
Bars Full Length of Beam
Bars 0.2 Length of Beam – Each End
Prestressed Strands
Self Lubricating Bearing Plate
D A B C B A D
8"
1'-2"
Flexcell Joint Filler
Drill 1 1/2" ϕ Holes in Pier After Beams Are Set – Fill Holes With Grout and Drive 1" ϕ Dowel Pins Through Grout Into Holes.
2'-6"
Expansion End Bearing
Beam Section
Fixed End Bearing

Strand Designation	Length of Strand to be Shielded to Prevent Bond
A	4'-0" Each End of Beam
B	6'-0" Each End of Beam
C	8'-0" Each End of Beam
D	10'-0" Each End of Beam

Courtesy Consulting Engineer

● **SMALL-SPAN bridge design: Details of box-girder supports and shielding to bond between prestress strands and concrete.**

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Onondaga County Highway Department, Jamesville, New York, relies on Cat No. 12 Motor Graders for all its grading work. Here's one of them on a typical job—widening road from 18 to 24 feet. In 8-hour days, its scarifying and grading production averaged 380 feet a day. Stanley Bronner, who is experienced in operating most other make graders, says: "The No. 12 is far superior. It has better traction, better visibility and works in the toughest going at a steady pace."

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Public records from communities all over the country prove that the low total cost of Cat Motor Graders makes them the best investment for taxpayers' dollars. Get these facts, which cover yearly operation and maintenance, from your Caterpillar Dealer. See for yourself how a Cat Motor Grader is your best buy!

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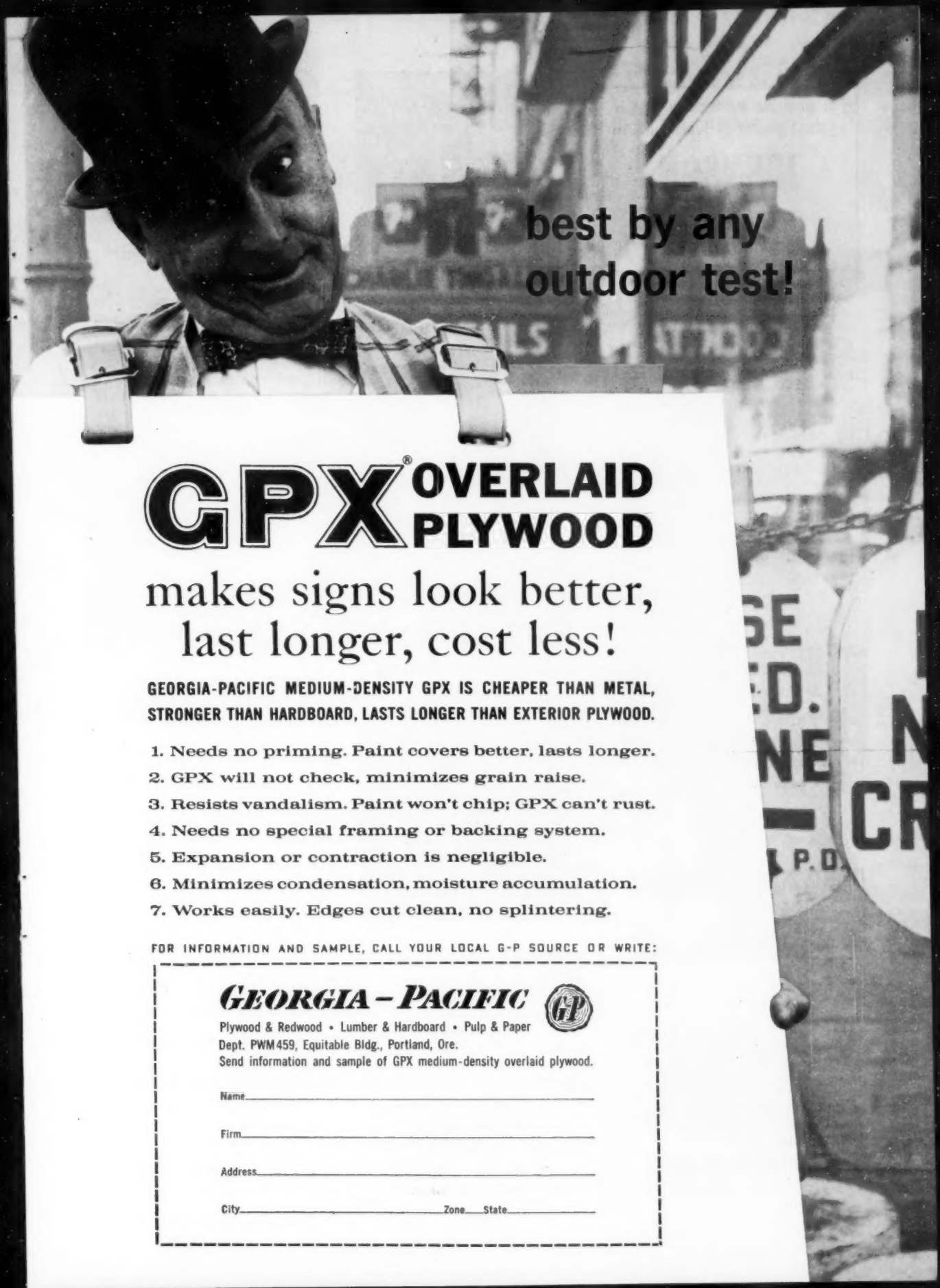
cally and speedily for city streets and secondary roads in communities, townships and counties. In Highland Park, Ill., four bridges had to be replaced and it was found that casting yards in the area were equipped to turn out shallow prestressed box-girders at competitive prices. They had standard forms for 17-in., 21-in. and 27-in. depth deck units. The 17-in. depth met all requirements for the Highland Park bridges except the specified limitation as to tensions in the top of the units near the supports. To reduce this tension, it was decided to encase some of the stressing strands in paper tubes near the supports. Within each girder, two 10-in. diameter Sonovoid tubes were run full length (except at diaphragms and end blocks) to reduce dead weight of the deck units. Each deck unit was 3-ft. wide and designed to support an AASHO-H20 loading. For simplicity, all of the bridges were designed for nominal 40-ft. spans, and the cost of the deck was quoted at $8 psf, which included production, erection, grouting and transverse tensioning. Three of the bridges had three spans and one had four and only one was straight while the others had some degree of curvature. A 2-in. course of bituminous concrete was laid on the deck units. The reinforced concrete approach slabs were 10 ins. thick and 20-ft. long.

"Designing Small Span Bridges." By Harold F. Sommerschield, Suter & Sommerschield, Architects & Engineers. *Consulting Engineer*, February, 1959.

Computer Speeds Bridge Design

The consulting engineering firm of Alfred Benesch and Associates is using an electronic general-purpose digital computer to solve both complex and routine engineering problems. So far eight programs are being processed through the computer. These are: Traverse closure; vertical alinement; analysis of rectangular reinforced concrete columns; analysis of circular reinforced concrete columns; influence lines for continuous-beam design; reinforcing steel quantities; composite-beam design; and detailed stringer geometry. Although the number of programs in use at the moment are limited, production time of the computer has risen to 87 hours in the fourth month of operation. In the design of a composite beam the job would take an engineer a full day, with the computer it takes approximately 20 minutes. The



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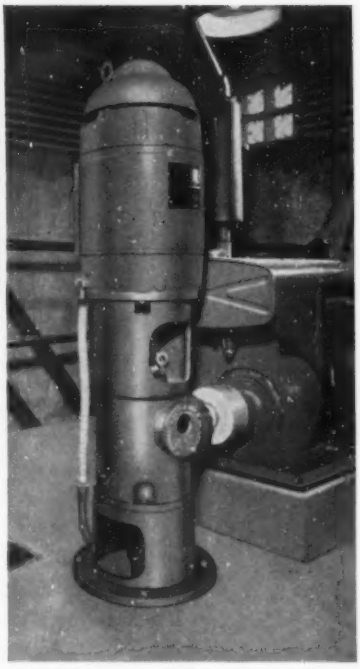

Cross State Development Co. installed the Johnson combination drive shown here in a sewage disposal plant in Florida. They report: "It's recognized as one of most efficient, packaged systems in the Tampa area. We've never experienced any difficulty." Neither will you because Johnson combination drive assures engine take-over the instant electricity fails. Either power unit may be overhauled without interrupting service.

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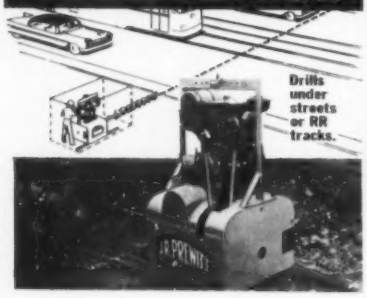

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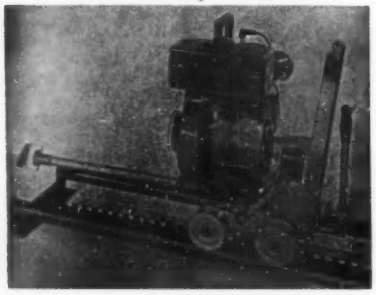

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"Electronic Computer Speeds Bridge Design." By A. Benesch and E. H. King, Alfred Benesch and Associates, Chicago, Ill. *Better Roads*, January, 1959.

Old Narrow Bridges Are Being Replaced

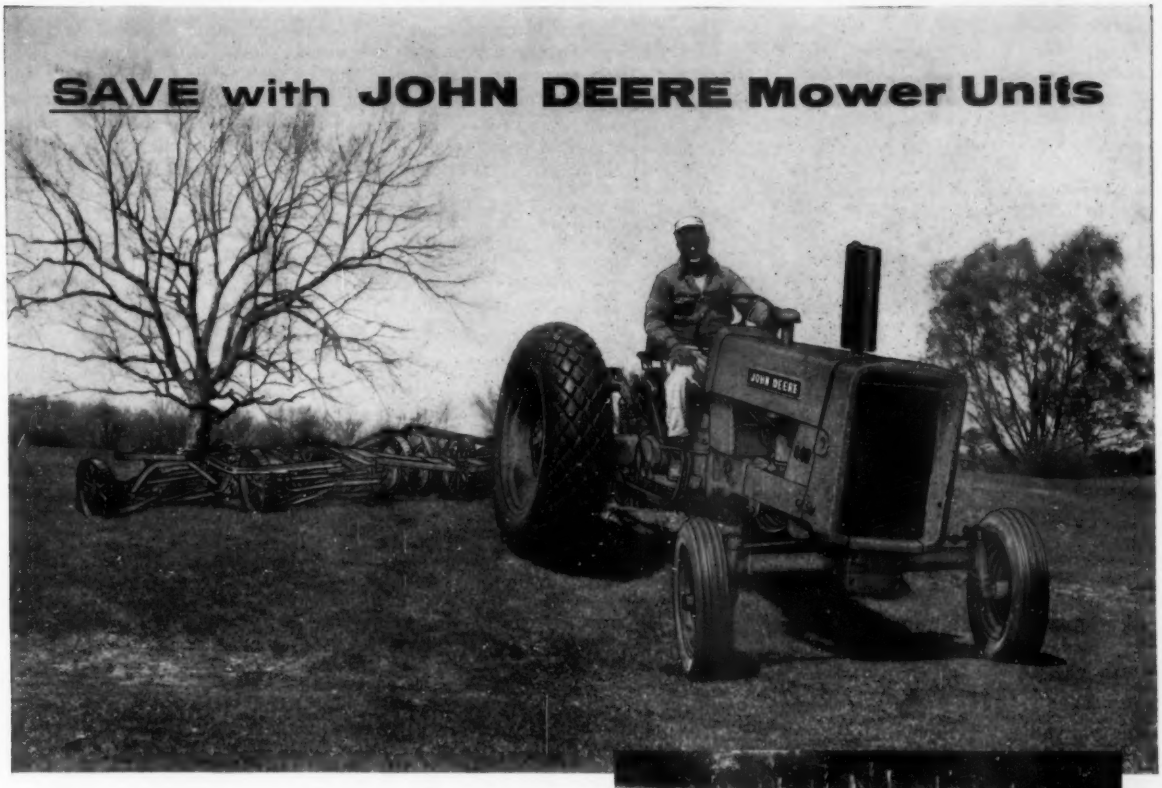
More than 350 narrow "killer" bridges were widened on Indiana highways in 1958 under the Indiana State Highway Department's precast Portland - cement - concrete bridge widening program. This brings the total to over 1,000 bridges that have been widened in the last three years. Bridges with spans up to 40 ft. have been widened with precast-concrete units while structures with spans of more than 60 ft. have been built using prestressed, precast concrete units. Most of the work has been carried out by the maintenance division of the highway department with the heavy crane equipment and compressor units being leased. The average cost of the widening jobs was $1,593 with the average width of the bridges widened being 19 ft. 2 in. Five steps are taken in the precast bridge program. First, the piles are driven or the abutments are formed. If piles are used, they are cut to proper length and fitted with pile caps. Then the old handrail is knocked off with a drop ball. The precast units are brought to the site and lifted into place by a crane. Finally, the approaches to the bridge are widened to the new width of the bridge. In the "crash" bridge program carried out by the department, narrow and damaged steel-truss bridges are completely replaced with prestressed, precast-concrete structures. Two cranes, two compressors and a crew of 20 to 30 men can remove the old structure and place the new concrete units in place in about 12 hours. These bridges are designed for an H-20-S 16-44 loading.

"Indiana Is Eliminating Its Old Narrow 'Killer' Bridges." By John Peters, Chairman, Indiana State Highway Department. *Better Roads*, January, 1959.

Road Reconstruction Program With Calcium Chloride

Steuben County, N. Y., in its 10-year road reconstruction program will spend $12 million. A 4-point program is considered which consists of 1) reconstructing 354.75

By the Acre or by the Mile...



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miles; 2) surface treatment and maintenance of 126.30 miles (now under 16-ft. in width; 3) top a total of 156.15 miles which is already constructed; and 4) keep bridge reconstruction in pace with the road construction and weight limits. The retopping program will cost approximately $1.8 million. This is based on an estimated cost of $15,000 per mile for plant-mix material and $8,000 per mile for double honing. Rebuilding of the bituminous surface roads will cost approximately $13,000 per mile for base construction, and total construction costs are estimated at $34,000 per mile. In the construction procedure, the old roadways are scarified and the base is widened by trenching to the desired width, 16, 18 or 20 ft. Depending on the thickness of the existing base, additional courses of bank-run and crusher-run bank gravel are added until the desired 18-in. thickness is achieved. A minimum of 12 ins. of bank-run or fieldstone material is desired, and 6 ins. of crusher-run of bank material. An application of from 2 to 4 tons of calcium chloride is applied to hold the fines and to bind the materials together for the subbase. Three types of surface courses are used: 1) Gravel mulch, followed with a plant-mix surface; 2) a 1½-in. penetration top, followed with a series of honing, or retread surfaces to build up the thickness; and 3) the plant-mix top of a minimum of 2½-in. thickness. The county owned equipment used on construction includes 4 dozers, 10 graders, 3 ¾-yd. shovels, 3 crushers, 15 trucks, 8 box-type spreaders, 15 Scotchman spreaders, 40 Whirligig trailer type spreaders and 15 tractors.

"Rural County's 10-year Road Reconstruction Program." By Robert A. Reed, County Highway Supt., Steuben County, N. Y. PUBLIC WORKS, March, 1959.

Pave Instead of "Shovel Patch"

A 128-block beginning was made last year in North Little Rock, Ark., to pave streets with 6-in. soil-cement base and a 2-in. bituminous riding surface. An annual expenditure of $150,000 of state gasoline turnback funds for re-building existing streets was used to finance the building program. The soil-cement pavement was placed at $1.02 psy with cement required varying from 8 to 12 percent by volume. The city bought the following equipment to do the job: Rubber-tired tractor with front-end loader; cement spreader; Vibro-Plus roller; D4 Caterpillar sheepsfoot roller; pneumatic tired roller; and a steel wheel roller. They had on hand a Pulvimixer, motor grader, asphalt spreader, distributor, water wagon and an assortment of trucks. A crew of three machinery operators, three truck drivers and three laborers were able to pave the 128 blocks in 59 paving days, or 1,700 sq. yds. per day in widths which varied from 18 to 36 ft. The approved methods of soil-cement construction was adhered to. Surface treatment consisted of 0.1 to 0.2 gal. psy of an emulsified asphalt and water, mixed 50-50, applied by the distributor. This treatment was designed to serve both as a curing membrane for the soil-cement base and as a tack coat. A 2-in. asphaltic riding surface was placed on top of this.

"North Little Rock Decides to Pave Instead of 'Shovel Patch'." *Street Engineering*, February, 1959.

City Wide Street Program

Officials in Presque Isle, Maine, abandoned the piecemeal plan of repairing streets and replaced it with a program that would immediately affect the city's major arteries and, over a ten-year period, would

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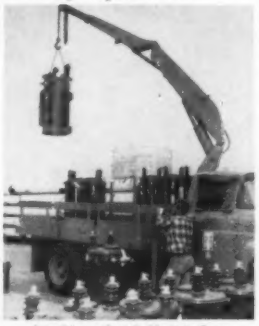

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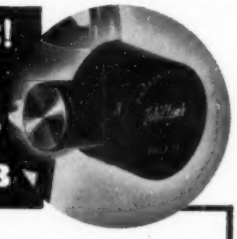

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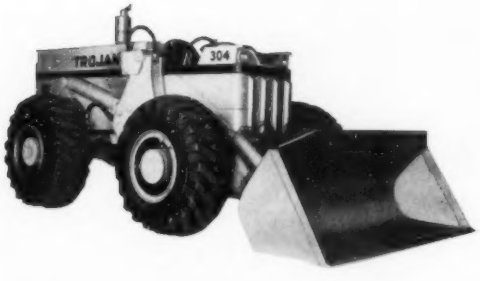

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result in the rehabilitation of every street in town. An engineering study was made of the city streets to ascertain the condition of the various streets, the state's plans for the area, the present and anticipated volume of traffic and the availability of funds. The report indicated that both a short and a long range program were needed. The most practical method of attacking the immediate problem was to concentrate funds and efforts on a priority basis against specific streets and sections. In the preliminary inspection only a few streets were found to be in satisfactory condition. The data formed the basis of a six-group priority system, with the six groups costing $2,645,000. Primary thoroughfares having a three and four-rod right-of-way were designed for 30 and 40-ft. pavement widths. Pavement widths for secondary streets having a two-rod right-of-way were made 20 and 24 ft. Wheel loads of 12,000 and 7,000 lbs., respectively, were used to figure the depth of road beds. Since the cost of excavating to depths below the expected frost level of 5 feet was prohibitive, a plan was developed whereby extensive underdrains permitted lesser depths. The design covering residential streets calls for 18 inches of subbase gravel; heavily traveled streets required 30 ins. The paving material was 2½ ins. of bituminous concrete for all surfaces. Granite curbs were specified throughout the city.

"Presque Isle's City-Wide Street Program." By Homer S. Briggs, Senior Engineer, Fay Spofford & Thorndike, Inc., Boston, Mass. *The American City*, February, 1959.

Highway Ramp Areas Become Flood Control Reservoirs

The time-honored solution of providing ponding areas (sometimes called flood-control reservoirs), long used in the design of major control works, is usually overlooked in highway design. The inclusion of such areas in highway drainage systems can be easily done. The geometry that dictates modern interchanges can be the salvation of the designer who is looking for a place to create a storm-water storage area, especially the trumpets, half-trumpets and cloverleafs. There has never been enough borrow available for the freeway profiles necessary in metropolitan areas and the extra excavation between highway ramps will create a ponding area. This is a temporary storage of highway drainage until it can conveniently enter the sewer system. When peak flows in the local system have subsided, then the control reservoir begins contributing. No maintenance controls are required other than those dictated by the laws of hydraulics and the size of the reservoir outlet pipe. An example of how this is working on the Northern Illinois Toll Highway near Berkeley, Ill., is described in this article.

"Highway Ramp Areas Become Flood Control Reservoirs." By Edward Forrest, Chief Civil Engineer, Anderson-Nichols and Co., Boston, Mass., and Harvey G. Aronson, Chief Hydraulic Designer, E. L. Paulo, Consulting Engineer, N. Y., N. Y. *Civil Engineering*, February, 1959.

Other Articles

"White Lines in Harrisburg." **Traffic problem** has been solved in downtown section. The American City, February, 1959.

"Lack of Money County's Biggest Handicap." In spite of insufficient funds county has made great progress in replacing bridges and cross drains and raising roadbeds above high water. By T. L. Reynolds, Attala County Engineer, Kosciusko, Miss. Better Roads, January, 1959.

"Well Planned Signs Helped Put Across Traffic Changes." **One-way streets and parking restrictions** were

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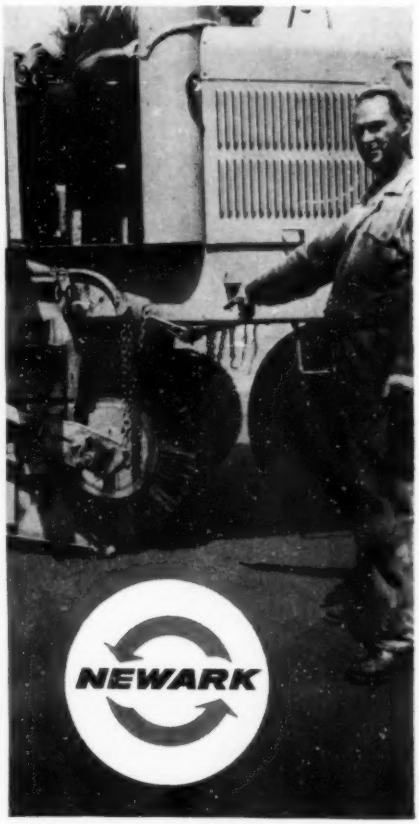

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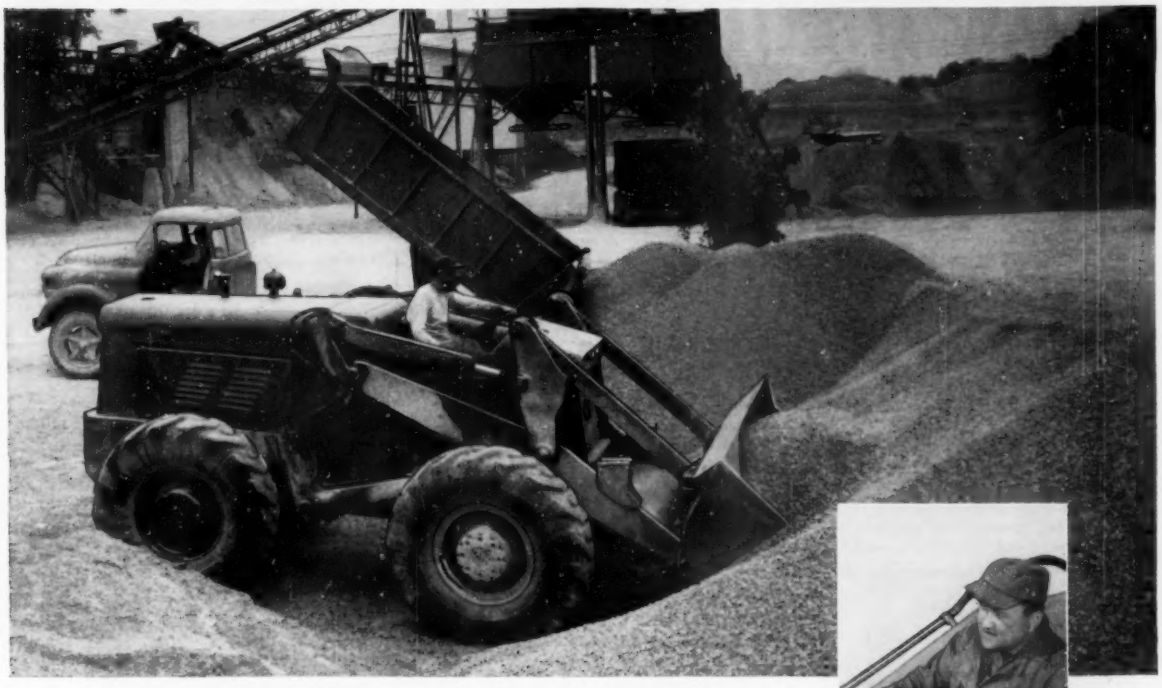

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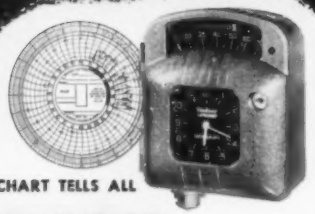

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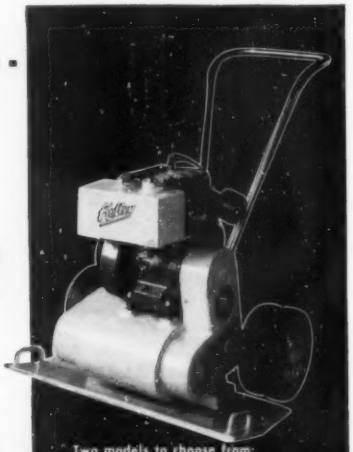

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Below, Model 18KT packing down sub-base materials on a road-widening job.

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initiated in Cedar Rapids, Ia., with a positive plan of communication including reflectorized signs. By Robert M. L. Johnson, Commissioner of Public Safety, Cedar Rapids, Ia. Street Engineering, February, 1959.

"**Prestressed Concrete Standards** for New Lights in St. Louis." The contractors used the drill-set-tamp method on these one-piece poles in raising 2,000 new luminaires. By A. W. Baer, Project Engineer, Sverdrup & Parcel, Engineers-Architects. Street Engineering, February, 1959.

"**Small Computers** For Small Firms." By William A. Briggs, Burgess & Niple, Consulting Engineers, Columbus, O. Consulting Engineer, February, 1959.

"Public Purchasing." **Buying equipment** at the county level is described. By James F. Meisner, Marion County Engineer, Marion, Kans. Public Works, March, 1959.

"New Jersey Turnpike Utilizes **Electronics for Traffic Surveillance.** Radar counts and determines the speed of vehicles traversing the busy toll highway. By Leo Sands. Public Works, March, 1959.

"Orthotropic Plate Design for **Steel Bridges.**" By Roman Wolchuk, Head, Bridge Dept., Frederic R. Harris, Inc., Consulting Engineers, N. Y., N. Y. Civil Engineering, February, 1959.

"Progressive Alterations in a **Sheet Asphalt Pavement** Over a Long Period of Service." By Jarl T. Pauls, Chief, Bituminous Branch, and Woodrow J. Halstead, Head, Bituminous Materials Section, Bureau of Public Roads. Public Roads, February, 1959.

"New Kansas **Curve Signs Reduce Deaths.**" New reflective signs at turns and curves and "impact" placement at the more dangerous of these locations, have reduced "left-road-at-curve" fatalities by 43 percent. By Claude W. McCamment, Director of Safety, Kansas Highway Commission. Traffic Engineering, February, 1959.

"**Lime Stabilized Subgrade** for Kansas 'I' Project." Soil with objectionable swell characteristics treated at part of concrete-paved Interstate project 15½ miles in length—states largest stabilization job to date. Roads and Streets, February, 1959.

"Purchase Your Machines—or Rent?" This analysis for a tractor utilizes a procedure which will take much of the guess work out of the question of **buying vs renting equipment.** By R. L. Peurifoy, Professor of Construction Engineering, Texas A & M College. Roads and Streets, February, 1959.

"Emulsified Asphalt **Slurry Seal.**" Highways and Airports. By A. E. Holberg, Canadian Bitumuls Co. Ltd., Toronto. Roads and Engineering Construction, February, 1959.

"**Mass Rapid Transit** to Serve the Super Cities." By Irvan F. Mendenhall, Daniel, Man, Johnson & Mendenhall. Consulting Engineer, March, 1959.

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7045

SOIL-CEMENT SUBBASE for Interstate Pavements

J. W. CRAVENS,

District Administrative Engineer, Texas Highway Department

This is a condensation of a paper presented at the 57th Annual Convention of the American Road Builders' Association, at Dallas, Tex.

THE FEDERAL Aid Highway Act of 1956 contained the provision that construction standards for the Interstate System should be adequate to accommodate the types and volumes of traffic forecast for the year 1975. At the time Congress passed the Highway Act in 1956, the pavement design was being studied for a 15-mile section of Interstate 30 extending from Greenville towards Dallas, Texas.

The best source of information in regard to pavement performance in this area seemed to be the history of the pavements actually in service. Subgrade soils were of such a nature that they were weak when wet and subject to considerable volume change due to moisture fluctuations. Liquid limits as high as 110 and P.I. as high as 86 were found in the subgrade soils of the proposed project. A liquid limit of 151 and a P.I. of 118 were found for a soil from a proposed borrow pit. The variable rainfall in the area adds to the problem. As an example, the rainfall at Greenville was 26 inches in 1956 and 75 inches in 1957.

Plate tests were made on a number of existing bases in service under light traffic and "K" values were computed. For comparison, "K" values were also computed for the underlying clay subgrades. These values were obtained from triaxial tests on undisturbed cores. For the plate tests, a 30-inch diameter plate was used and the tests were made as outlined in the PCA Manual on Concrete Pavement Design.

The combination of soil-cement on a layer of granular material showed the greatest "K" values for anything tested. Values for the soil-cement ranged from 314 to 610 as compared to 35 to 90 for the clay subgrades.

Unconfined compression tests were made on laboratory specimens of available granular materials in a saturated condition. These tests indicated that 35 lbs. per square inch was about the maximum strength that could be expected from any of these materials.

Since soil-cement on a layer of granular material showed the greatest "K" values, this type of construction was selected as a subbase for the pavement. Two good local materials were available as mineral aggregate for a cement treated subbase. One was a sandy soil at an average haul of about 9 miles from the project. The other was a limestone deposit at an average haul of about 22 miles. Laboratory tests indicated that a mixture of the sandy soil and 6 percent cement by weight would give a compressive strength of about 225 lbs. per square inch. The limestone, crushed to pass a 2-inch screen mixed with 2 percent cement would give about the same strength. Estimates of cost indicated that the cement-treated soil would cost about $0.75 per square yard, 6 inches thick as compared to about $1.00 per cubic yard for the same thickness of cement-treated crushed stone. The cement-treated soil was selected on the basis of economy.

It had been observed that concrete pavements on strong subgrades retained their load transfer qualities at joints and cracks so it appeared logical to design on the basis of protected corners. For a 20,000-lb. wheel load, 650-lbs. concrete and a "K" value of 300, present criteria indicates that a thickness of 10 inches for the slab is adequate, so this thickness was selected.

The length of pavement in the project, excluding bridges was 14.8 miles. For 11.4 miles, the subgrade had soils with P.I. not over 40. The remaining 3.4 miles had soils with P.I. from 40 to 86. Where the P.I. was under 40, a 6-inch layer of selected soil was used. For higher P.I. a 10-inch thickness was used. Specifications for the select material required a liquid limit not over 45; a P.I. not less than 4 and not over 15; and 55 percent of the minus 40 to be plus 270 material.

A 6-in. layer of cement treated soil was placed for a width of 41 ft. on the roadbed treatment. With a 24-ft. concrete slab, a 10-ft. outside shoulder and a 5-ft. inside shoulder, the subbase extended 1 ft. beyond the crown lines or outside edges of the shoulders.

The shoulder construction above the subbase consisted of a 10-inch thickness of crushed stone adjacent to the concrete tapering to a 6-inch thickness at the outside edge, with a light double asphalt surface.

Soil for the selected material and the cement treated subbase were obtained from two sources several miles apart, but the two pits were very similar. Both deposits were about 20 ft. thick and generally had a layer of clay from 1 to 2 ft. thick near the surface that had to be wasted. As a rule, only one pit was operated at a time, the material being suitable for either roadbed treatment or cement treated subbase with operations of placing the two layers being carried on simultaneously. The roadbed treatment operation was usually several thousand feet ahead of the subbase operation.

Enough material was placed for the subbase to be finished about ½ in. above grade to allow for trimming to exact grade. Cement was spread with a Flynn spreader. Mixing was accomplished with Seaman-Andwall mixers. Initial compaction was secured by a sheeps-foot roller with a spike tooth harrow removing compaction planes. Final compaction was secured with pneumatic tired rollers and the subbase trimmed to exact grade with motor graders.

Careful handling was necessary to finish the subbase close enough to secure a satisfactory yield from the concrete since the slab was paid for by the square yard. On this project, it was the responsibility of the Highway Department to set blue tops as needed to control the finish. Five stakes were set every 50 ft. This kept a 5-man field party busy most of the time. On a similar project now under contract near Sulphur Springs, it is the Contractor's responsibility to set the necessary grade stakes or otherwise control the finish of the subbase to a satisfactory tolerance. On the Greenville project, the loss in yield for the concrete was 1.3 percent.

It was found that form pins could be driven without difficulty with air hammers. No shattering or cracking of the subbase was caused by driving the pins. After removal of the pins the holes were tamped full of the cement treated soil.

Cores have been taken from the completed subbase and tested for compressive strength. Tests from 25 localities showed an average compressive strength of 160 psi.

Photo by Benrimo Studio

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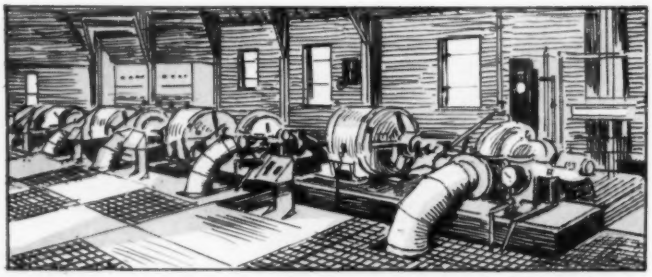


Prepared by **ALVIN R. JACOBSON, Ph. D.**

Associate Professor and Head, Division of Sanitary Science, Columbia University School of Public Health

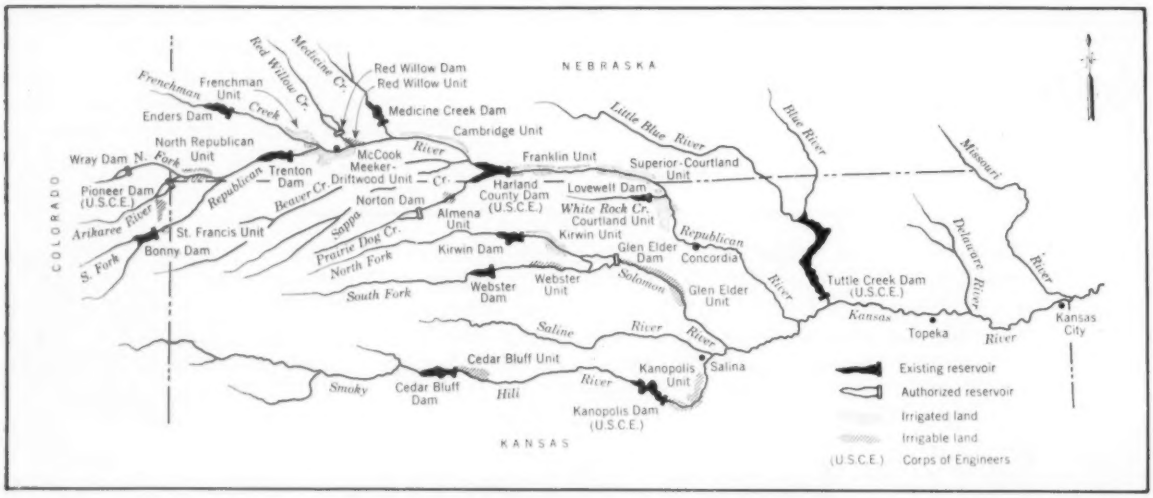
Kansas River Basin

Steady progress is being made on the development of the water resources in the Kansas River drainage area which is an integral part of the Missouri River Basin Project. Of the eleven dams authorized for construction by the Bureau of Reclamation, eight have been completed as shown in the accompanying illustration. This project envisions the conservation, control, and use of the basin's water resources through the cooperative efforts of federal, state and local governments. The major benefits will be irrigation, production of hydroelectric power, flood control, and navigation. Other benefits are municipal and industrial water supplies, new recreational facilities, fish and wildlife conservation, pollution abatement and silt detention. The drainage basin is about 480 miles long and about 140 miles wide and is subject to high winds, intense rainstorms and wide variations in temperature. The principal industries in this area are agriculture and the processing of agricultural products. The author has included several tables presenting details concerning physical and hydrologic data as well as other information on the dams and reservoirs. The costs to conserve and control drainage areas show a pattern of $3,000 to $4,000 per sq. mile for those in the 4,000-sq. mile range up to about $8,000 per sq. mile in the 1,000-sq. mile range. Other field costs and relationships are also presented in detail.

"Water Resources Developed In Kansas River Basin." By A. D. Soderberg. *Civil Engineering*, February, 1959.

Water Supply Problems

The water works industry must examine in a straight-forward manner many of the new problems endangering the quantity and quality of America's water supplies. Detergents, insecticides, fertilizers, pesticides, herbicides, and other organic chemical complexes are finding their way into our water sources. Intensive research in three areas is essential to meet these challenges: 1) Augmentation of supplies of water by new means; 2) conservation and reduction of water losses, and 3) controlling and treating the new contaminants. Conversion of sea water may be feasible within the next 15 years for cities along the sea coast. Recharging of underground reservoirs to supplement conventional surface storage is also believed possible as a means of augmenting the present water supplies. The development of practical methods of reducing evaporation losses from surface supplies by the use of hexadecanol or other suppressants is an important means of conserving water. New and improved processes for reclaiming water to meet the future requirements of all intended uses must be developed. Particularly needed is an inventory of the above-mentioned



Courtesy Civil Engineering

● **AUTHORIZED projects of Bureau of Reclamation in Kansas River basin. These are part of overall plan for Missouri Basin.**

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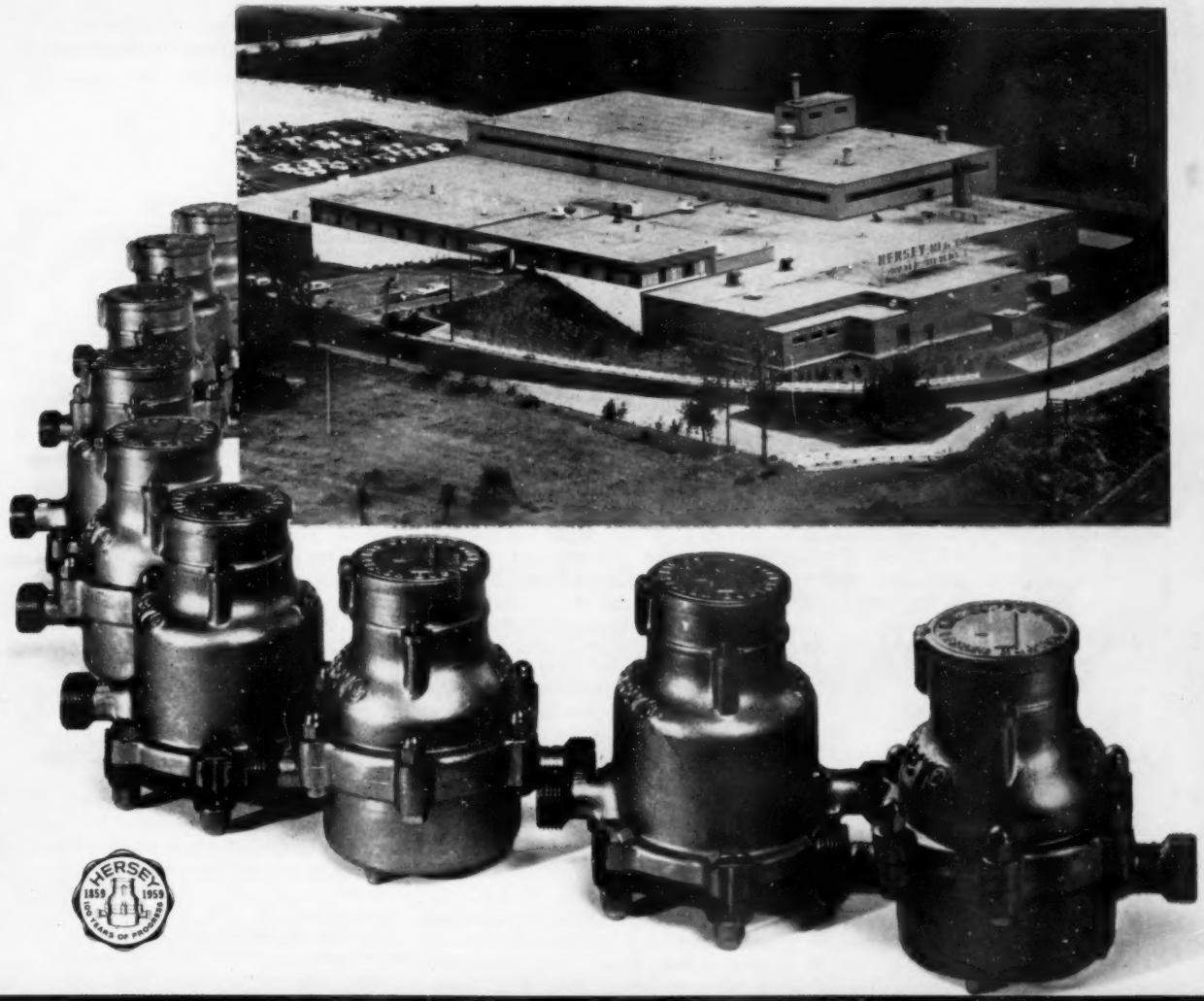

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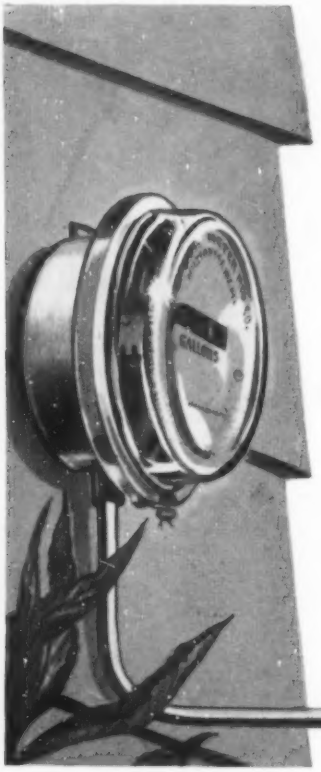

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specific organic chemicals contained in drinking water that originate from sewage or industrial waste, from surface run-off, or are deliberately added to water for plant or fish control. The toxicological significance of most of the organic chemicals in drinking water supplies has not been adequately evaluated. In addition, a critical evaluation of the effectiveness of removal of infectious hepatitis and other viruses by conventional water treatment practices is needed.

"We Must Take a Hard Look At New Water Supply Problems." By Mark D. Hollis. *Water Works Engineering*, February, 1959.

Chlorine Residuals

In his article the author discusses some of the common pathogenic biological inhabitants of water and their significance and evaluates the status of current knowledge of their control by chlorination. He enumerates the disease-producing organisms that merit consideration in connection with chlorine disinfection, discusses the utility of the coliform index and the recognized bacteriological standards of acceptable drinking water quality and the basis of chlorination practice to insure a bacteriologically-safe water. The efficacy of chlorine disinfection of water is influenced by these major variables: 1) Amount and type of chlorine present, and equilibrium; 2) relationships between coexistent chlorine forms (a function of pH); 3) presence of chemical and other chlorine demanding complexes; 4) duration of contact; 5) temperature; and 6) type and density of bacteria, virus, algae, protozoa, and other microorganisms and their susceptibility to chlorine. An extensive discussion of the effectiveness of chlorine on the control of the various types of pathogenic organisms found in water is provided. Thirty-five references add to the excellence of this article.

"How Safe Is Your Chlorine Residual." By Edmund J. Laubusch, S.M. PUBLIC WORKS, March, 1959.

Improvements at Elizabeth, N. J.

The Elizabethtown Water Co., serving a large and rapidly growing industrial and residential area in central New Jersey, has doubled its production since 1950. This water system can obtain its raw water from any one of 3 surface sources, the Raritan or Millstone Rivers or the old barge canal of the Delaware River, according to the quality of each source at any time. The filter plant, constructed in 1929, consisted of a low-lift pump station, a plain sedimentation basin, coagulating basins, gravity filters and a high lift pump station. The 20 mg plain sedimentation basin was converted to a true coagulation basin because of the small quantity of turbidity in the raw water. Other developments to aid in the improvement of water quality are the construction of an illuminated clear well, a viewing well, a recording flow colorimeter, and two underwater periscopes. All of these devices are used for making critical observations of the appearance of the water in an effort to improve the quality. Activated carbon is used for taste and odor control and the carbon feed must be maintained by laboratory threshold odor and taste tests performed hourly by the operators on hot water furnished continuously from different points of the plant by three hotwater (140°F) fountains. Carbon is added at the influent while chlorine is added at the effluent end of the coagulation basin. Considerable research has been conducted to determine the most effective points in the plant for the addition of chlorine and the best method for the control of residuals. Additional study was successful in determining the most effective coagulants and

coagulant aids for the continually variable raw water obtained from the two rivers and the barge canal. This informative article illustrates the fact that a high quality water can be produced, even in older purification plants, if the problem is approached with intelligence and a willingness, when necessary, to depart from conventional methods.

"Plant Improvements and Quality Control at Elizabeth, N.J." By James Girard. *Jour. A.W.W.A.*, February, 1959.

Colorimetric pH Determination

The colorimetric pH test is determined by adding certain organic dyes called indicators (each one having a specific pH range) to a water sample. The developed color should be clear and strong and should have the same color, intensity, and hue as the prepared standards. When there are deviations in the color formation, they may be the result of any one or any combination of the following reasons: 1) Wrong concentration of indicator solution; 2) the use of too little or too much indicator solution; 3) incorrect volume of sample; 4) incorrect viewing depth; 5) contamination of indicator solution; or 6) presence of free chlorine or chloramine residual. When it is difficult to judge which standard the developed color most nearly matches or when it is immediately evident that the color is not even near the standard color either as to intensity or hue, then action should be taken to find out why. The author discusses each of the reasons and how they may be corrected.

"Accurate Colorimetric Determination of pH in Swimming Pool Water." By A. E. Griffin. PUBLIC WORKS, March, 1959.

Seven-Fold Water Expansion

The phenomenal population increase of Aurora, a suburb of Denver, Colorado, from 11,421 in 1950 to an estimated 35,000 at the present time has necessitated the development of an interesting domestic water project. First was the development of wells along Cherry Creek as an initial phase in the overall plan. This plan consisted of four 1,000 gpm wells, the necessary piping and a 4.5-mg storage reservoir which would supply the city by gravity. In addition, the city purchased about 10 cfs of irrigation water from the owners of a ditch supplied from the South Platte River. Litigation is continuing on the allocation of approximately 62 cfs for future needs. The present demand is approximately 3½ mgd, with anticipated demands of 5-6 mgd by 1962, and 40 mgd within 25 years. The new works consist chiefly of a concrete diversion structure at the ditch, 1800 ft. of 24-in. steel pipe providing gravity flow to a concrete presedimentation basin; a 10 cfs capacity pumping station; 14,000 ft. of 24-in. steel pressure pipe; an earthen equalizing reservoir; a water treatment plant; and 18 miles of 40-in. steel pipe providing gravity flow to Aurora. This project will assure the City of Aurora an adequate water supply for many years in the future.

"Water Project Designed For Seven-Fold Expansion." By J. D. McGillis and G. A. Claussen. PUBLIC WORKS, March, 1959.

Polyelectrolyte Coagulant Aids

Recently considerable interest has been given to a new set of complex chemical compounds — polyelectrolytes—which have been found to be effective in varying degree as coagulant aids. This article presents the results of a study of seventeen polyelectrolytes, the studies having been

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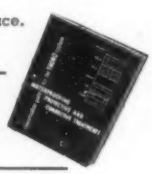

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confined to the effectiveness of the materials as coagulant aids in the removal of turbidity with alum. The following conclusions were drawn from the data presented: 1) The polyelectrolytes vary widely in their effect on floc formation. 2) The type of settling varied from very poor to excellent with the different coagulant aids. 3) Most of the materials tested were effective to a greater or lesser degree in reducing the turbidity of the settled water to values below the corresponding controls. Some of them, however, had little effect, and a few inhibited floc formation. 4) Most of the polyelectrolytes were effective in low concentrations—many of them in fractions of 1 mg/L. 5) The order of addition of the coagulant and the polyelectrolyte was found to be important; in most of the present study the coagulant aid was added a minute after addition of the alum. Additional studies are being made on their effectiveness in removing organic color and when used in lime or lime-soda softening. Electrophoretic studies are also being planned to determine the effect of polyelectrolytes on zeta potentials in order to add to the understanding of the basic mechanisms of coagulation.

"Effectiveness of Polyelectrolyte Coagulant Aids in Turbidity Removal." By A. P. Black, A. I. Ball, A. L. Black, R. A. Boudet, and T. N. Campbell. *Jour A.W.W.A.*., February, 1959.

Other Articles

"Value and Limitations of **Chlorine Residuals** in Distribution Systems." A panel discussion presented on April 22, 1958, at the Annual Conference of the American Water Works Association at Dallas, Texas. Jour. AWWA, February, 1959.

"Big Pipe Job Completed." A description of the **$200,000,000 expansion program** now being undertaken by the Metropolitan Water District of California. The American City, February, 1959.

"Regulation of Water Resources." Dr. Wolman discusses some of the basic reasons behind the need for constant awareness by everyone where **legislation pertaining to water resources** is being considered. By Dr. Abel Wolman. Water and Sewage Works, February, 1959.

"Planning Water Supply Resources to Meet Expansion." In this article the author reviewed the planning of **water supply resources in the State of Florida** and used the experiences of the City of New York to illustrate results from improper water supply planning. John E. Kiker, Jr. Water and Sewage Works, February, 1959.

"Subterranean Water Collector." This

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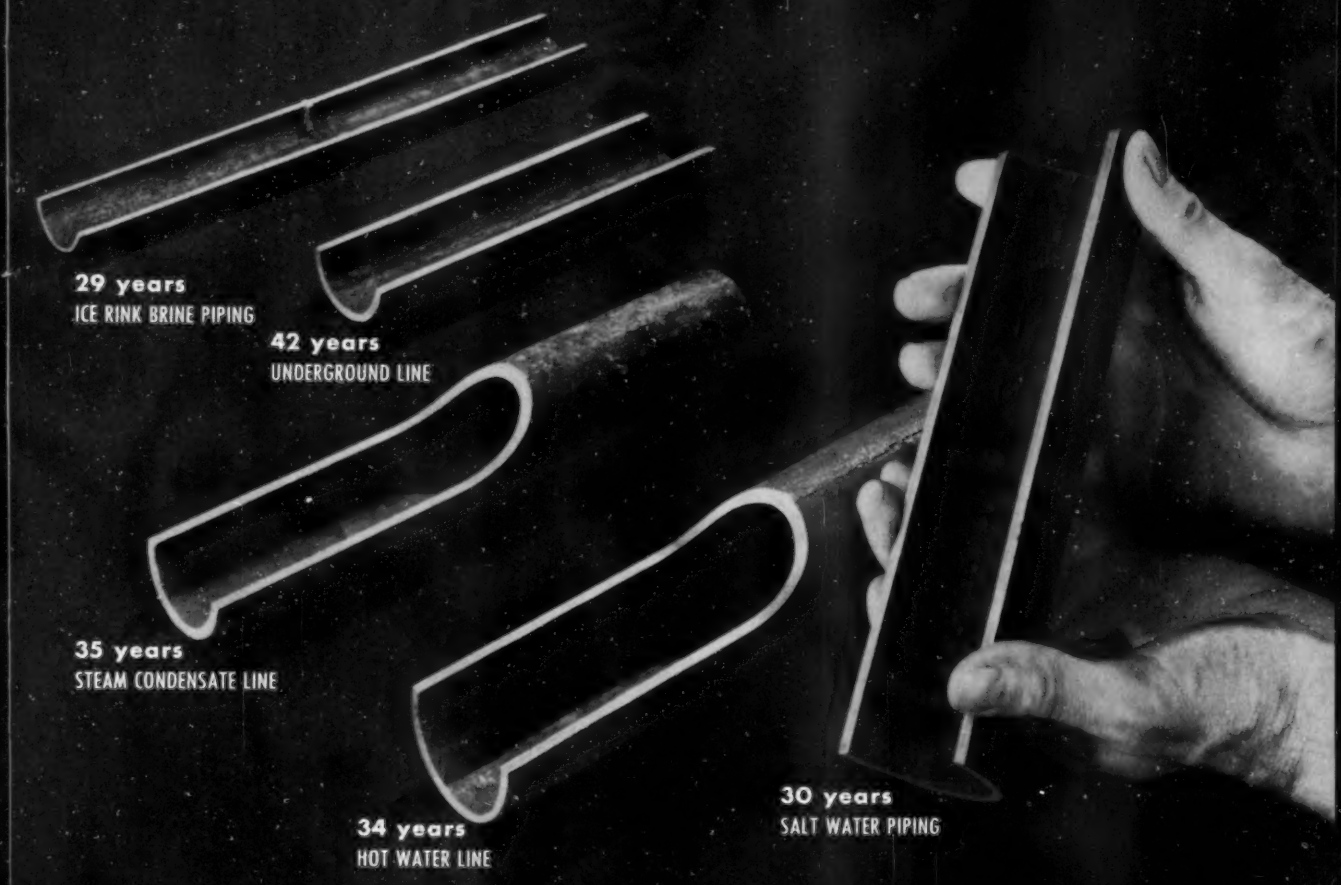

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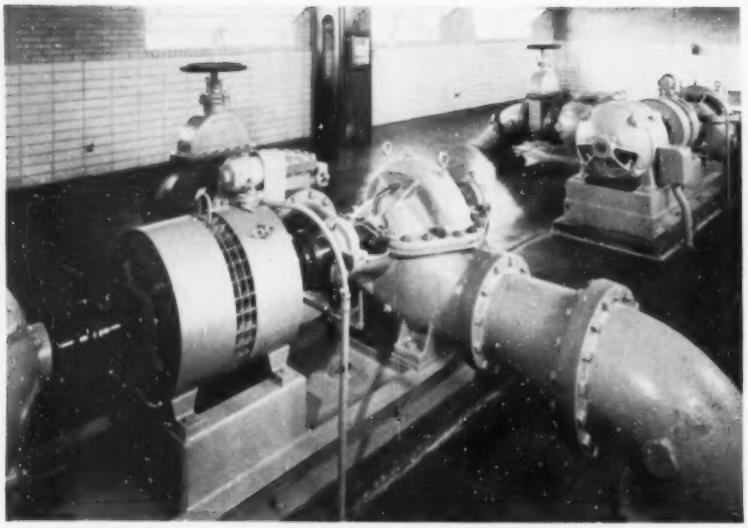

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RESULT: Odessa took the advice of its consulting engineers and is now enjoying efficient, low cost pumping.

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article describes a relatively recent development in Switzerland of a **system of underground water collection.** By H. Fehlmann and J. H. Fehlmann. Water and Sewage Works, February, 1959.

"Mechanism of Corrosion May Explain Problems." The author reviews the basic fundamentals and uses well-known experiences to explain the **mechanism of corrosion in ferrous metals.** By Arthur G. Keller. Water and Sewage Works, February, 1959.

• • •

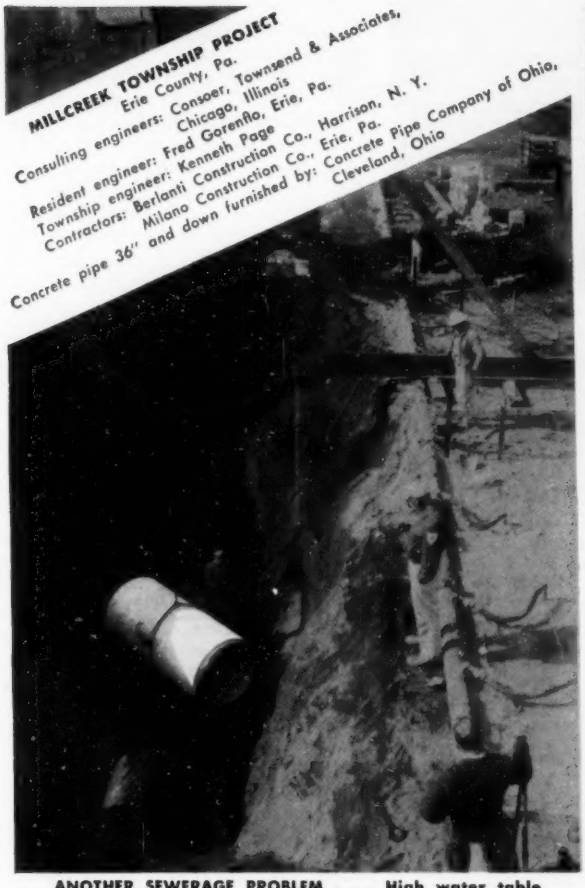
Increase in Public Health Research and Training Facilities Recommended

FROM an analysis of the changing character of national needs, the Consultants on Medical Research and Education to the Secretary of the Department of Health, Education, and Welfare have recommended substantial increases in the research and training activities of the Bureau of State Services of the Public Health Service.

The Bureau of State Services cooperates with State, professional organizations and other health groups to apply public health programs which will control and prevent disease. In addition to providing financial, technical and consultative services nationally, it administers Federal health activities in which the United States participates abroad.

The central activity of the Bureau of State Services is the support and encouragement of operating public health programs. Since public health practice, not research, is the primary function of the Bureau, the research program is derived from the operating missions of the Bureau. However, to attract and retain a staff of high caliber, the Bureau encourages a moderate amount of undirected research.

The Bureau operating activities supported by research include professional leadership to State and local health departments. As an idealized model, the Bureau takes new findings, adapts them to public health practice through demonstrations and applied research, and then assists in the training of people required for widespread application of the new technique. In total, these research and training activities are quite extensive. Of the $28 million appropriation for all direct operations of the Bureau in 1958, $14.5 million was accounted for by research. In 1952, in contrast, research expenditures were only $6.5 million, or 30 percent of the Bureau's budget for direct operations.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Township engineer: Kenneth Page
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ANOTHER SEWERAGE PROBLEM . . . High water table in project's 15 square mile area promised to impose severe strain on pipe joint seals. Gaskets would have to meet rigid specifications for effectiveness, strength, long life.

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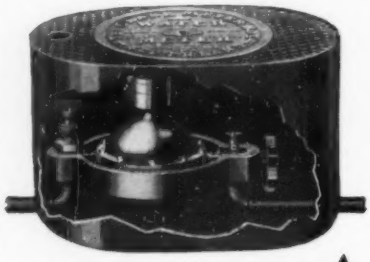
Left, No. 16 Clark Wonder Lock Meter Box Round....16" and 18" diameters. Large 13" lid.



Above, No. 11 Oval Clark Wonder Lock Meter Box, especially for warmer climates. H-11", L-18", W-12".

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Above, A-2-11 Clark Single Lid Meter Box Cover, 4" throat. Also available in 6" and 9" throat.

Below, B-2-11-L Clark Double Lid Meter Box Cover, 6" throat. Also available in 4" and 9" throat.

Above, AA-3-12 Clark Meter Box Cover with 13" Wonder Lock Lid, for use with 15" (illustrated), 18" and 20" box body.

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Wonder Lock Lid (bottom view) showing forged bronze bars.

Perfect Lock of one-piece manganese bronze forging.

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The sanitary engineering institutions conducting research and training programs under the Bureau of State Services include the Robert A. Taft Sanitary Engineering Center, the Occupational Health Field Station at Cincinnati and the Communicable Disease Center in Atlanta, Ga.

Among the special assumptions of national changes that will affect the activities of the Bureau are, of course, population factors; a shortage of personnel trained in public health professions; certain special alterations of the environment; and social changes affecting public health practice. These factors, and others, indicate that research will probably expand in absolute terms and in relative importance among the activities of the Bureau.

State and local expenditures for health services are rising steadily, while total Federal funds supplied to States for health services have declined since 1950. This trend will probably continue. One of the consequences will be to expand the technical advisory role of the Bureau and to contract its role as a disbursing agent. An increase in the research activities of the Bureau of State Services will result from this change in emphasis.

The chronic diseases are increasing and the communicable diseases are decreasing in relative importance as causes of illness and death. Much less is known about the prevention and treatment of the chronic diseases, as a group, than about communicable diseases. The role properly played by public authorities in the prevention, control and treatment of chronic disease remains to be worked out. For communities the problems created by chronic disease are social and economic, as well as medical. More intensive study of the social and economic aspects of chronic disease is indicated.

Health hazards arising in one State and exerting adverse effects in others, and hazards of such scope that States cannot deal effectively with them, are becoming more significant. These hazards include the increasing use of ionizing radiation, through nuclear reactors as power sources; the introduction of new industrial processes and products, such as synthetic chemicals, at a rapid rate with attendant potential health hazards; and more extensive air and water pollution as metropolitan areas expand and as industrial production rises. All of these indicate a clear need for a more extensive Federal public health research program.

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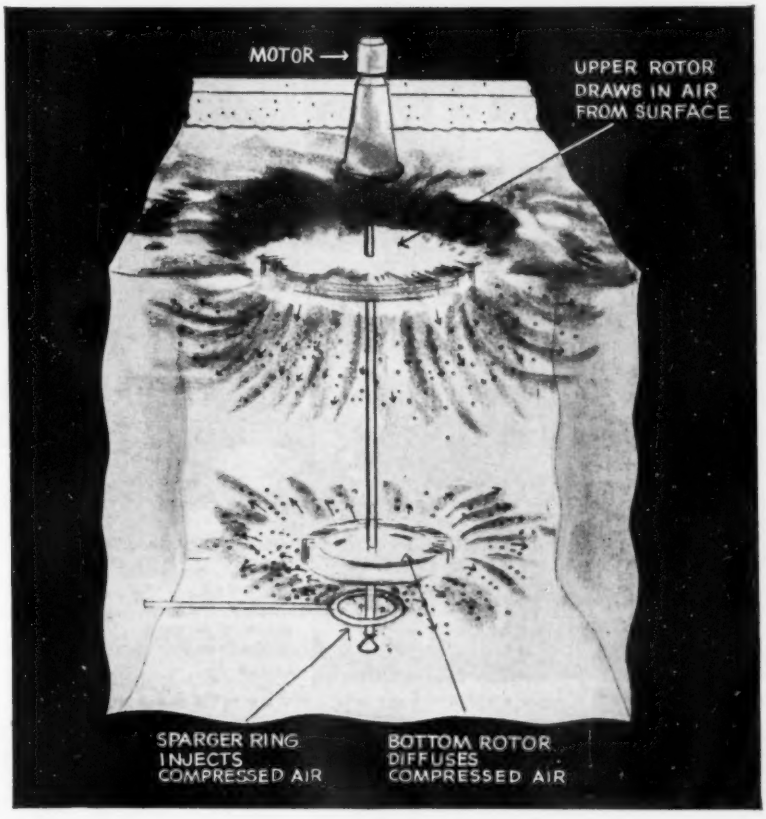

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Permutit's design of the double turbine introduces oxygen from the surface as well as from a sparger ring. Oxygen transfer per horsepower has increased from conventional rate of .86 lb. per hour to 1.5 lbs. per hour.

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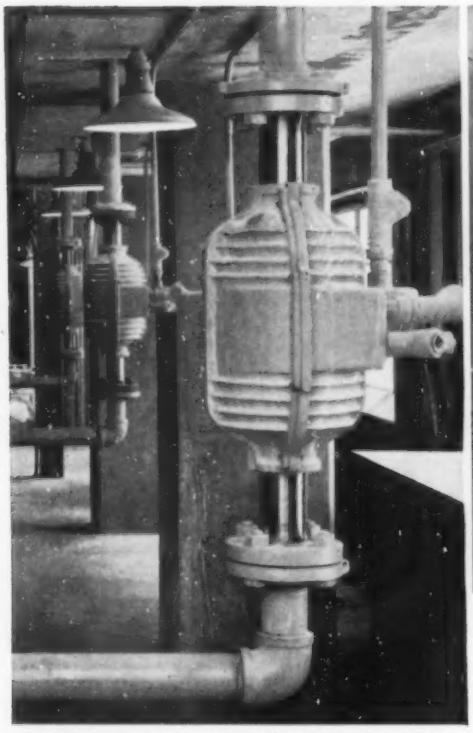
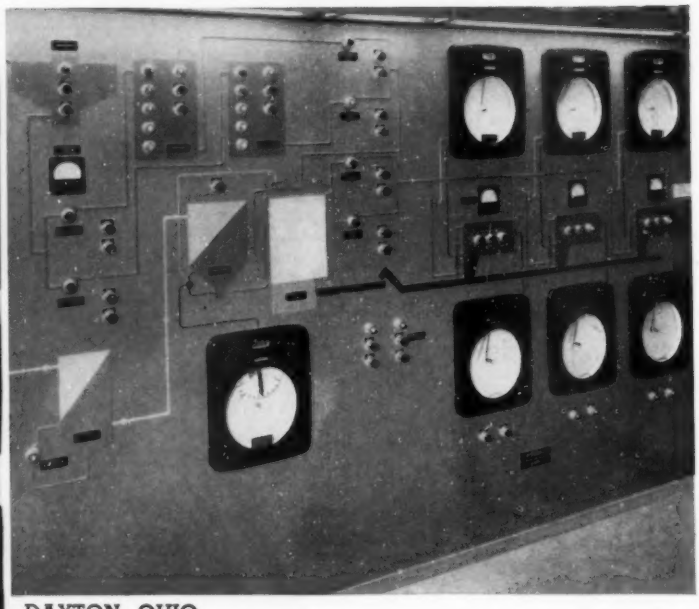
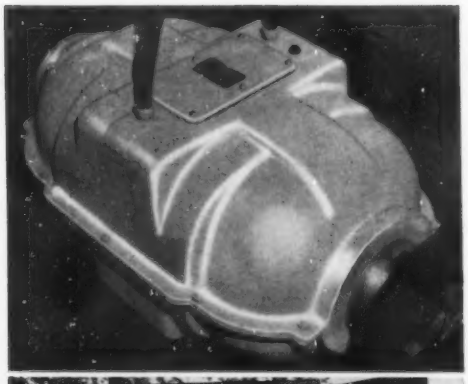
Line Restriction

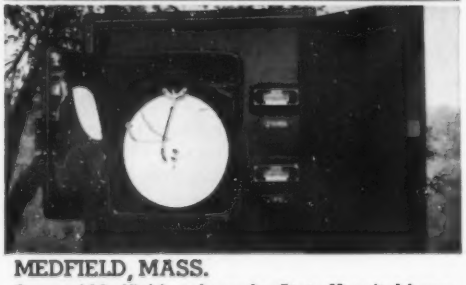




DAYTON, OHIO

Three Foxboro Magnetic Flow Meters measure flow of sludge to centrifuges at Dayton's Lime Recalcining Plant. Designed around these meters, plant actually recovers up to 20% more lime than originally added to water. Graphic control panel in Feed End Building operates entire plant.



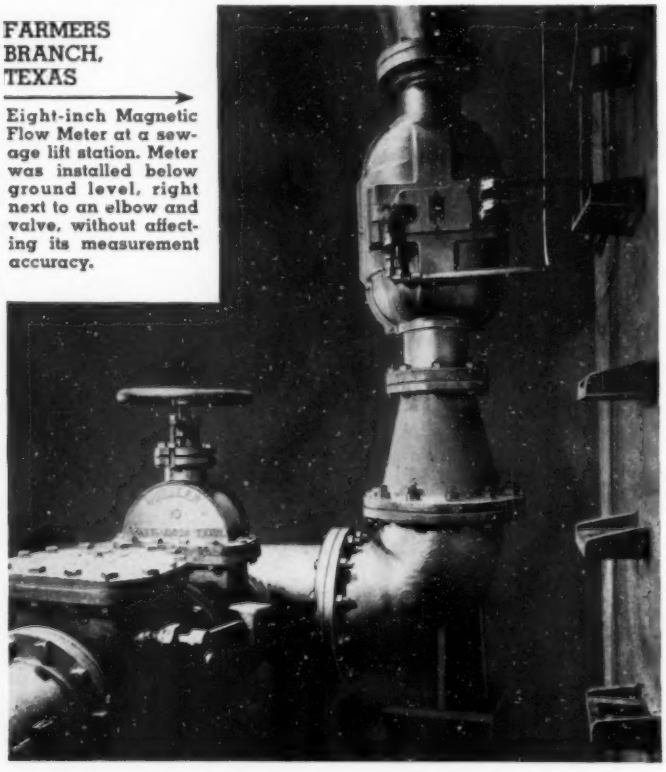


MEDFIELD, MASS.

Town of Medfield and nearby State Hospital have independent water supplies – use common storage facilities. Foxboro Magnetic Meter measures and records flow rates in both directions. Two integrators, next to recorder, keep separate running totals of both flow rates.

FARMERS BRANCH, TEXAS

Eight-inch Magnetic Flow Meter at a sewage lift station. Meter was installed below ground level, right next to an elbow and valve, without affecting its measurement accuracy.



Problems Eliminated!

for these municipal utilities equipped with Foxboro Magnetic Flow Meters

Introduced five years ago, the Foxboro Magnetic Flow Meter has proved its superiority for measuring water, sewage, sludge and other treatment plant flows.

Foxboro Magnetic Meters are installed the same as a length of pipe. Measurement is linear and is transmitted by electric cable to centrally-located Dynalog* Flow Recorders. There are no line restrictions of any type. That means no added pressure drop . . . no meter runs or straightening vanes.

Maintenance on the Magnetic Flow Meter is practically nil. There are no pressure taps to get plugged or frozen. There are no seals or purges . . . no moving parts to foul.

Look over the installations on these pages. And for complete details write for Bulletin 20-14C. **The Foxboro Company, 264 Norfolk Street, Foxboro, Mass., U.S.A.**

*Reg. U. S. Pat. Off.

Other Progressive Communities Installing Foxboro Magnetic Flow Meters

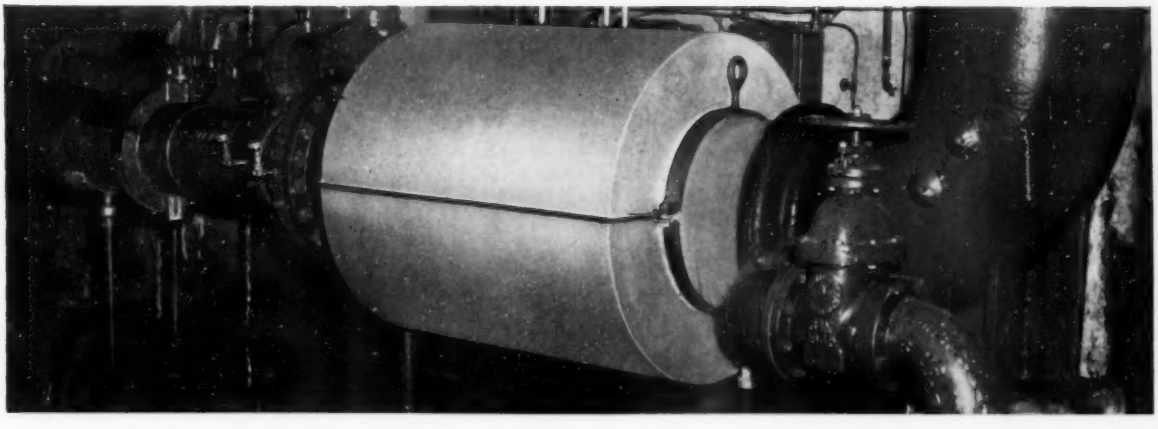
Benton Harbor, Michigan	— raw sewage
Hayward, Calif.	— water
Pittsburgh, Pa. (Allegheny County Sanitary Authority)	— raw sewage
Covington, Ohio	— return activated sludge
Warren Township, Michigan	— raw sewage and sludge
Bloomfield Township, Michigan	— water
Seattle, Washington (Lake City Sewage Plant)	— sludge
Milwaukee, Wisconsin	— sludge
Piqua, Ohio	— sludge
Arkansas City, Kansas	— sewage
Sidney, Ohio	— return activated sludge
Frazer, Michigan	— raw sewage

Meter sizes on these installations range from 3 inches to 6 feet.

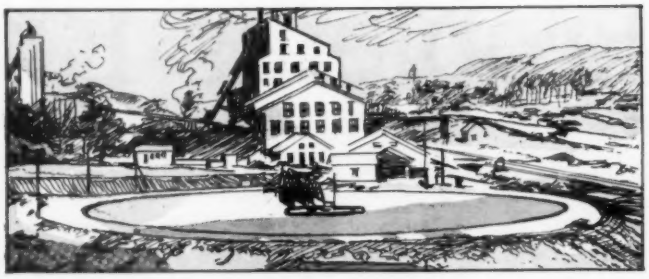
CHICAGO, ILLINOIS

This 20" Foxboro Magnetic Flow Meter was installed in the South District Filtration Plant in April, 1956. Because it has no line restrictions, plant officials knew the meter would add no more pressure drop than an equivalent length of pipe. Note how it was installed directly downstream from an elbow.

FOXBORO
REG. U.S. PAT. OFF.



THE INDUSTRIAL WASTE DIGEST



Prepared by **CLAYTON H. BILLINGS,** ***Associate Editor***

Spray Irrigation with Industrial Wastes

In Wisconsin, spray irrigation is the waste disposal method employed by 30 milk plants, 40 canning plants, a tannery, and sometimes for emergency disposal of sulfite liquor. Cover vegetation, by transmitting water and keeping the soil loose, is important to the success of the system. The maximum consumptive rate of the soil by evaporation and transpiration is about 8,000 gpad under the best weather conditions. Normally this figure is between 3,500 and 7,000 gpad. This is little affected by the type of forage crop grown. Drain tile can be used to advantage in poorly drained soils. It not only permits high volumetric loadings but removes concentrated salt solutions. A minimum tile depth is 2½ feet and the interval between lines should be at least 20 feet. Results have shown that nearly complete reduction in suspended solids is possible, accompanied by substantial reductions in bacteria and BOD.

"Disposal of Industrial Wastes by Irrigation." By F. H. Schaufnagel. *Public Health Reports,* February, 1959.

Treating Paper Mill Wastes with Sewage

The Middletown, Ohio, sewage treatment plant receives the white water from several paper mills. This waste may contain as much as 50,000 mg/L of solids consisting mostly of paper fibers plus some titanium oxide. The city's treatment plant uses chemical precipitation, which process is aided by the presence of the wastes. The sludge disposal problem, however, is enhanced by the necessity for handling 100,000 gpd from a normal total sewage and waste volume of 8 mgd. The sludge is also highly compressible, making it difficult to dewater. This factor was improved by recirculating the contents of the secondary digester, from bottom to top. This procedure caused agglomeration of fine particles, increased the alkalinity and lowered the volatile acids and CO_2 content. After recirculation, the sludge is pumped to the vacuum filter room and conditioned by lime alone. Experience showed that lime dosages of 12 to 13 percent on a dry basis yielded coke as satisfactory as lower dosages of lime and ferric chloride. This resulted in a saving of chemical costs which was later further reduced by using reclaimed lime from the water softening plant of Dayton, Ohio. The chemical cost for conditioning the sludge then amounted to only $2.08 per ton of dry solids filtered. Filtration is accomplished by means of a coil spring filter with yields obtained of 5 lbs. of dry solids per hour per sq. ft.

"Metal Media Vacuum Filters for Sludge Dewatering." By Kelsie B. Singleton. *Water and Sewage Works,* February, 1959.

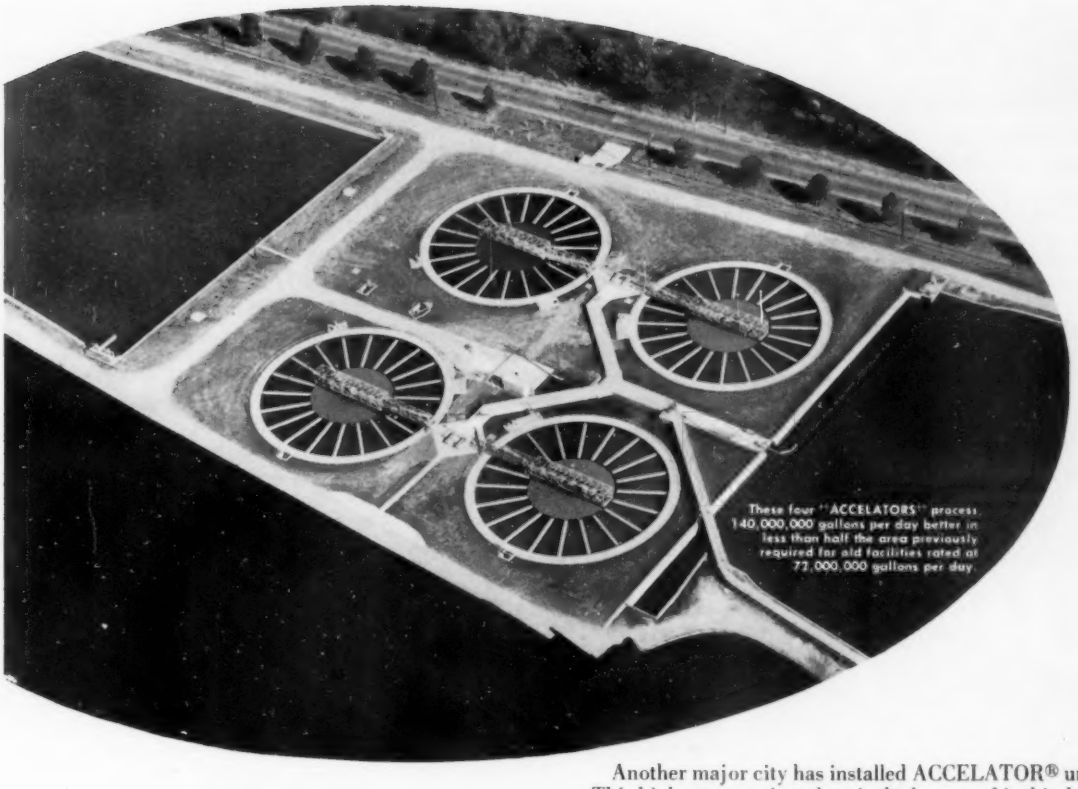
Determining Necessity For pH Control

The effectiveness of treatment of wastes by biological oxidation processes depends greatly upon maintaining the pH range of the system favorable to the growth of particular organisms. If a waste or supernatant does not have the necessary buffering capacity (ability to withstand sudden changes of alkali or acid concentration) to maintain the optimum pH, automatic pH control with addition of alkali or acid is desirable. A method for determining the buffering capacity of a waste makes use of the Van Slyke concept that a solution has a buffer value of 1 when a liter will take up 1 gram equivalent of strong acid or base per unit change of pH. The waste or supernatant is titrated with an acid or base and the volume of titrant is plotted against pH. The same is done for a selected buffer and the buffered waste. The slope of each curve is determined within a unit pH range closest to the effective zone of the buffer system. The buffering capacity is determined by the ratio of the slope of the waste curve to that of the selected buffer, expressed as a percent. A wide disparity in the slopes indicates the need for buffering. By the use of a Warburg apparatus, the oxygen uptake of the buffered and unbuffered wastes may be measured to show the benefits, if any, of using a buffer.

"Buffering Capacities of Wastes Determine Automatic pH Control." By W. H. Oldaker. *Wastes Engineering,* February, 1959.

Regeneration of Spent Refinery Caustic

Methods of regenerating spent caustic from petroleum refining heretofore have left air pollution or other problems which have discouraged their adoption by the industry. With the trend toward more stringent laws on stream and air pollution, Atlantic Refining Company has developed a process of direct oxygen regeneration. It involves application of oxygen in a gas-dispersion reactor under conditions of ambient temperature and pressure. Spent caustic containing mercaptans is charged directly to the regenerator where contact is made with oxygen. The oxidized caustic solution is settled and the disulfides formed from mercaptans are removed as supernatant and washed with gas, oil, or cycle stock. Sulfides and crude cresylic acids are also removed. The oxidation of a ton of sulfur as mercaptide per day requires slightly more than 4 cu. ft. of oxygen per minute. The cost of oxygen represents most of the expense of operation of the process with labor requirements negligible.


These four "ACCELATORS" process 140,000,000 gallons per day better in less than half the area previously required for old facilities rated at 77,000,000 gallons per day.

OMAHA CHOOSES INFILCO EQUIPMENT *for* WORLD'S LARGEST High-rate Water Treating Plant

...saves hundreds of thousands...doubles production in half the space with latest ACCELATOR® clarifying units

Consulting Engineers:
BURNS & McDONNELL ENGINEERING CO.
Kansas City, Mo.

Another major city has installed ACCELATOR® units. This high rate treating plant is the largest of its kind in the world, with a maximum rated capacity of 140,000,000 gallons per day.

The Metropolitan Utilities District of Omaha and their Consulting Engineers, Burns & McDonnell, selected solids-contact units for the treatment of Missouri River water because they provided the greatest capacity in the limited space which was available. Extensive studies and evaluation of competitive bids received proved that "ACCELATOR" units were the best answer.

Each "ACCELATOR" basin is 120′ in diameter by 27′6″ deep. Each unit is guaranteed to produce a high quality effluent at minimum chemical cost, and to have a capacity of 35 m.g.d. with water temperature above 65° F. or 20 m.g.d. with water temperature below 35° F.

Performance tests have demonstrated that each "Accelator" unit will clarify 41 m.g.d. with water above 65° F. and at least 31 m.g.d. with 35° F. water—using even less chemicals than were indicated in laboratory jar tests; and produced effluent turbidities substantially less than 10 ppm. Subsequent operations under hardness reduction conditions has produced even better results.

This is typical of the results being obtained in more than 2500 "ACCELATOR" treating plants, treating every type of water for municipal and industrial use.

Write today for copy of Bulletin 1825-D.

Inquiries also invited on coagulation, precipitation, sedimentation, filtration, flotation, aeration, ion exchange and biological processes.

INFILCO

INFILCO Inc.
General offices—Tucson, Arizona
Field offices throughout the United States and other countries

Eminence in design for water, sewage and waste treating and processing equipment...since 1894

"Direct Oxygen Regeneration of Spent Petroleum Caustics." By W. R. Lucas. *Industrial and Engineering Chemistry*, February, 1959.

Egg Shell Disposal In Sewers

Following a request from an egg-drying plant, the City of Topeka, Kansas, investigated the feasibility of accepting 6½ to 13 tons of egg shells per day into a 42-inch combined interceptor sewer. The shells were accepted on a trial basis for approximately a year. The industry installed a grinder with ⅛-inch screen openings. It was found that under normal operating conditions in wet weather, storm flow would keep the interceptor flushed out and a balance was maintained between the tonnage of shells discharged by the industry and that received at the sewage treatment plant. During dry periods, however, the figures failed to balance within one ton per day. The accumulation was such that the city decided to discontinue permanently the acceptance of the shells. There appeared to be no damage to pumps. Deposits of shells were found under each tubular air header in the pre-aeration tanks, and the grit accumulation in a digester not equipped with scrapers was found to have doubled, after the trial period.

"Topeka Tests and Bans Discharge of Egg Shells into City Sewer." By D. B. Kissinger, *Wastes Engineering*, February, 1959.

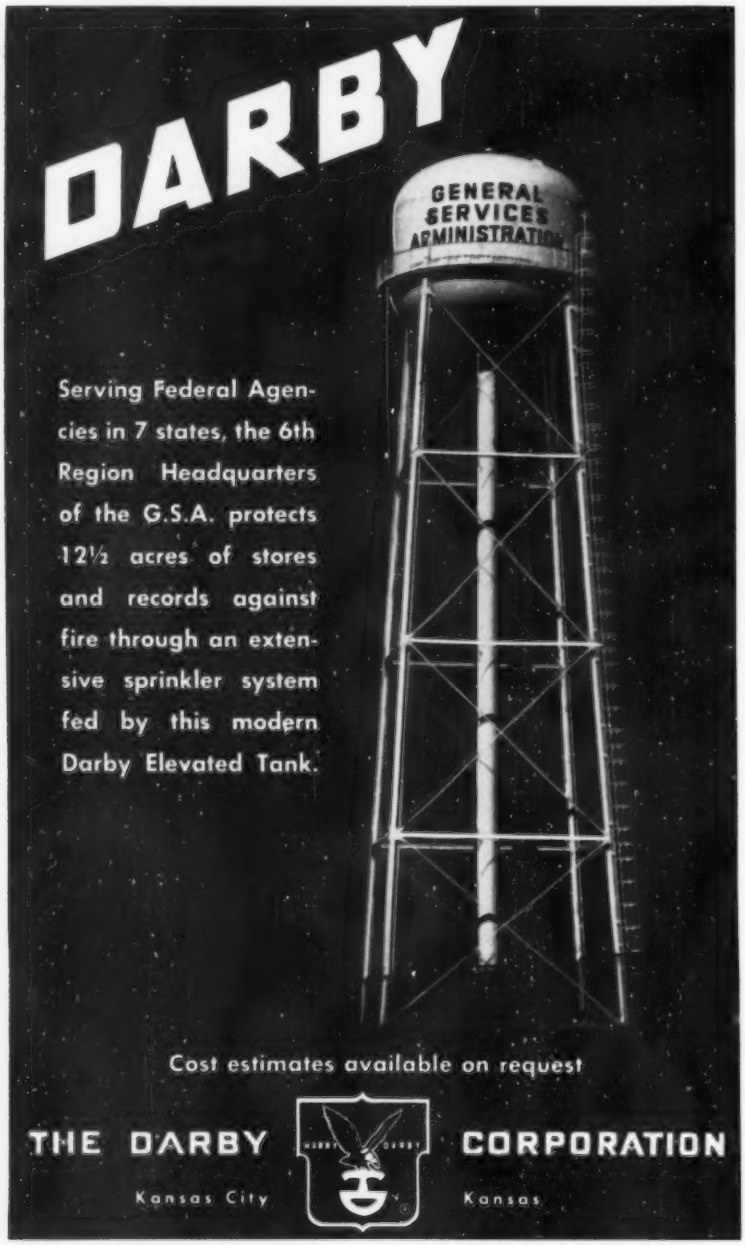
Finding Sulfite Liquor in Sea Water

The method originally employed for determining concentrations of spent sulfite liquor in sea water was a visual colorimetric test based on the nitrosolignin color reaction. Nitrosolignin is formed by adding nitric and acetic acid to the sample. Previous attempts to adapt the method to use with a photoelectric colorimeter resulted in optical interference from the presence of nitrite in the reagent blank. A spectrophotometric study was made by the authors of the nitroso color of lignin and of certain phenolic materials that may be present in samples. This study resulted in the development of an improved combination of light filters for use with the Lumetron colorimeter, eliminating almost completely the reagent blank and increasing the sensitivity and reproducibility of the test. Interference with the test, of such materials as extractives from bark and wood can be determined by the use of an alkaline blank solution of the water sample of the same pH as the reagent-treated sample. If disagreement is found between the results obtained using both neutral and the alkaline blanks, it is probable that interfering substances are present.

"Improved Spent Sulfite Liquor Determination by the Nitrosolignin Method." By Otto Goldschmid and L. F. Maranville. *Analytical Chemistry*, March, 1957.

Aerosol Sampling Centrifuge

Determination of the content of aerosols and reactions within them has been limited by techniques for removing the particles from their air-borne state. It is necessary to concentrate the particles in the sampling technique and to determine size and mass distribution. Research at the California Institute of Technology led to the development of the "aerosol spectrometer" which accomplishes both tasks. The unit, as recently made available commercially, contains a rotor in the form of a cone carrying a double helix, surmounted by an exactly fitting cup lined with a removable foil on which the par-


DARBY
GENERAL SERVICES ADMINISTRATION
Serving Federal Agencies in 7 states, the 6th Region Headquarters of the G.S.A. protects 12½ acres of stores and records against fire through an extensive sprinkler system fed by this modern Darby Elevated Tank.
Cost estimates available on request
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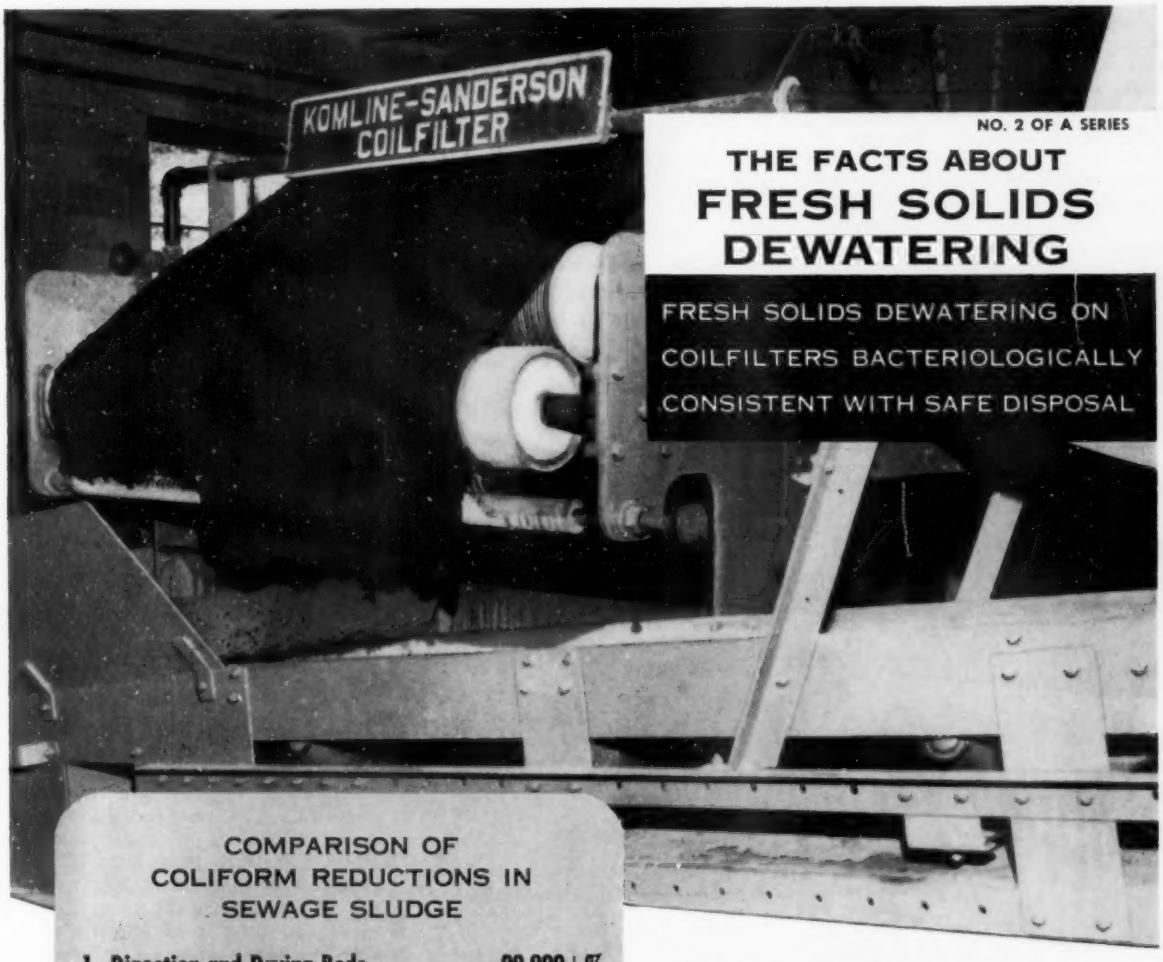

NO. 2 OF A SERIES

THE FACTS ABOUT FRESH SOLIDS DEWATERING

FRESH SOLIDS DEWATERING ON COILFILTERS BACTERIOLOGICALLY CONSISTENT WITH SAFE DISPOSAL

COMPARISON OF COLIFORM REDUCTIONS IN SEWAGE SLUDGE

1. Digestion and Drying Beds.....99.999+%
2. Digestion and Vacuum Filters.....99.999+%
3. Vacuum filtration of Fresh Solids.....99.999+%

Survey results at 18 sewage plants support laboratory findings that show dewatered fresh solids bacteriogical quality equal to that of dewatered digested sludge and to digested sludge from drying beds.

Chemical conditioning, high pH and water removal produce massive reductions of coliform population, rendering the final product suitable and safe for ultimate disposal by any of the standard available methods. As for odor, the filter cake is rendered biologically stable, precluding odor production or other nuisance.

The sewage treatment plant incorporating fresh solids dewatering costs less initially than a plant with another dewatering method—and it costs less to operate.

KOMLINE-SANDERSON ENGINEERING CORPORATION

PEAPACK, NEW JERSEY

MANUFACTURER OF COILFILTER SLUDGE VACUUM FILTERS AND AUXILIARY EQUIPMENT FOR DEPENDABLE FRESH SOLIDS DEWATERING

ticles are deposited. The rotor can spin at 25,000 rpm. The high velocity of the rotor creates the centrifugal field necessary to precipitate the particles, but because air flow is in the direction of the helical channels, it remains laminar. The shearing action on the particles is thus minimized. Size distribution occurs with larger mass particles settling first and the smaller progressively subsiding as the channel is lengthened. The deposits on the foils can be examined by the optical dark field microscope to be counted and classified into size groups. The foils can be replaced with analytical filter paper which can be cut into divisions with each division submitted to chemical or chromatographic analysis.

"The Aerosol Spectrometer." By Dr. Alexander Goetz. PUBLIC WORKS, February, 1959.

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Sewage Gas Engines

(*Continued from page* 103)

speed of the engine when the wet well is low during the night flow, resulting in engine stoppage. In 1947 the originally installed drum type governor was changed to the Pierce lever type, then considered to be an improved form. Slight wear in the governor parts reduces the engine's response to changing well levels, and at night, hand control and more alertness on the part of the operator are required.

The pump engines are directly connected to the pumps, without an interconnecting clutch. The engines are started by a motor with current from a 12-volt 1.90-2.05-amp. heavy duty battery. The engine, therefore, has the disadvantage of having to start under load. If the battery is low the engine is either difficult to start or there is an annoying waiting period until the battery charge can be raised. This implies battery expense and a careful battery maintenance schedule. Some saving has been effected by using a local battery reconditioning service.

The annual maintenance overhaul is an important factor in this record of engine performance. The work is done by the plant's personnel and without elaborate tooling equipment, mostly the ordinary hand tools. Valve grinding, the maintenance of the cylinder head blocks to renew valve rod sleeves and valve seats and testing for tightness is done in a local machine shop familiar with our needs. The cylinder head blocks occasionally develop cracks causing leaks. Efforts to have such blocks repaired by specialists has never proved satisfactory. The only home made tool used is an effective device consisting of some calibrated weights used in connection with a second degree lever system for checking the tension of the many valve springs. The overhaul usually requires about ten days for each engine after which they again run like new.

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Consulting Engineers Council to Meet in New York City

The annual general meeting of the Consulting Engineers Council will be held in New York City, April 28 through May 3. In addition to election of officers, the Council will consider: 1) standard forms for contracts; 2) development of a national public relations program designed to promote the consulting engineering profession; and 3) a group medical insurance plan. Also to be considered will be the proposed "Guide to the Practice of Consulting Engineering" which will incorporate the results of studies of office practices, fees and contracts, ethics, employee relations and minimum standards. Executive Secretary is Larry N. Spiller, Reisch Bldg., Springfield, Ill.

ALGAE-FREE WATER
MEANS
Copper Sulfate
treated water
Not only is Triangle Brand Copper Sulfate successful in controlling algae but it also is effective in killing some aquatic weeds. Since the weeds are submerged and disintegrated, there is no chance of them floating down stream to start new infestations, or to clog the waterway.
In sewage systems, Triangle Brand Copper Sulfate prevents roots and fungus from clogging pipes. However, there is no danger of affecting the surface trees owing to the low concentration of copper sulfate necessary to be valuable.
The new booklets "The Use of Copper Sulfate in The Control of Microscopic Organisms" and "Copper Sulfate for Root and Fungus Control in Sanitary Sewers and Storm Drains" will keep you up to date. Send for a copy today! Phelps Dodge Refining Corp., 300 Park Ave., New York 22, N. Y.
PHELPS DODGE REFINING CORP.
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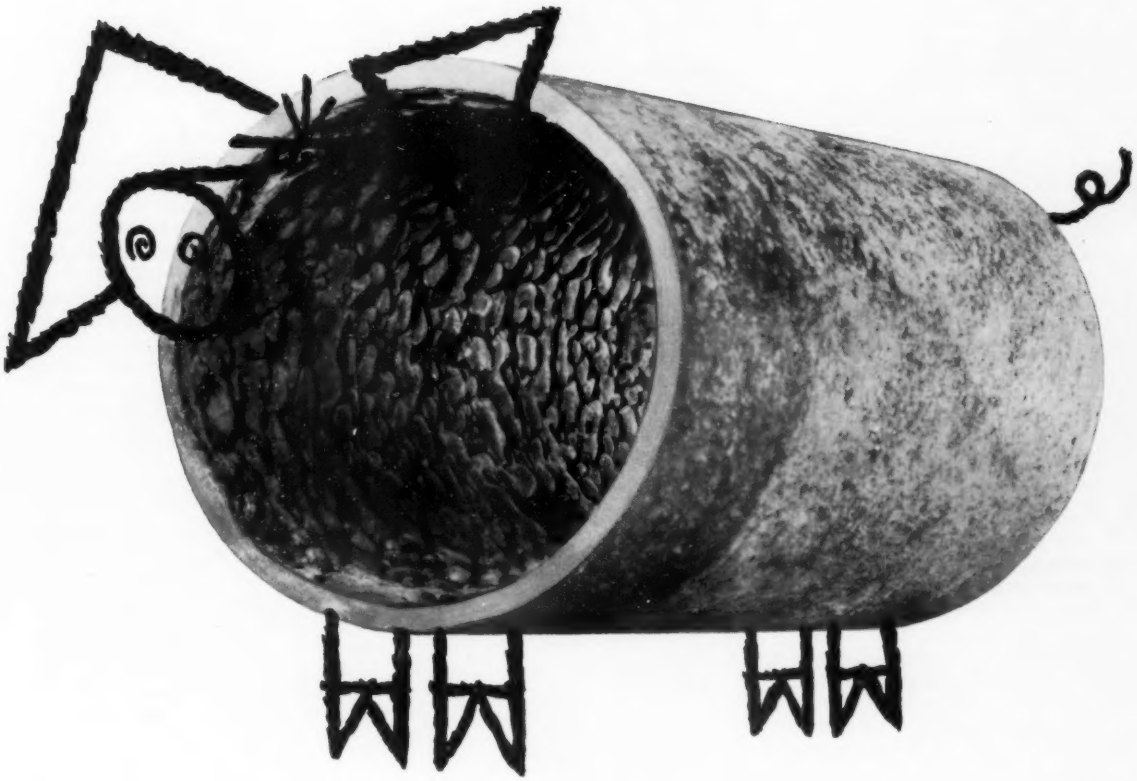
portrait of a power hog



When water flow capacities go down and pumping costs go up, the culprit is usually *tuberculation*. The way to deal with this power hog is right on his own ground — the inner surface of the water main. Here Calgon,® the simple and inexpensive way to deal with corrosion,† goes to work. By interposing a tough film between the metal surface and water, Calgon definitely controls corrosion.

Calgon treatment of the water is particularly effective after mechanical main cleaning because of its fast film-forming ability. Protection for freshly scored metal surfaces is quickly built up and easily maintained. Calgon treatment is as inexpensive as it is effective — a few ppm control tuberculation and other corrosion problems as well.

A letter or phone call will bring you more information on how Calgon can help. Or, an experienced Calgon engineer will be glad to make detailed recommendations on your specific problem.

CALGON COMPANY
DIVISION OF **HAGAN** CHEMICALS & CONTROLS, INC.
HAGAN BUILDING, PITTSBURGH 30, PA.
In Canada: Hagan Corporation (Canada) Limited, Toronto

†Fully licensed under U.S. Patent 2337856

PRESSURE CHANGES AT STORM DRAIN JUNCTIONS

Bulletin No. 41, "Pressure Changes at Storm Drain Junctions," is a report on research sponsored jointly by the Missouri State Highway Dept. and the Bureau of Public Roads. Model studies for determining pressure changes at various rectangular and circular junction structures are covered. Included is a design section embodying detailed procedures and working charts for use in design of storm drain junctions. Authors are W. M. Sangster, H. W. Wood, E. T. Smerdon and H. G. Bossy and copies are available from the Engineering Experiment Station, University of Missouri, Columbia, Mo. The complete report costs $2 and the design methods cost $1.

FUNDAMENTALS OF PIPE DRAFTING

This book is designed for students who have accomplished the basic skills of mechanical drawing and wish to develop specialized skills in the field of pipe drafting. The contents of the book represent the type of information from which the student draftsman of limited experience can best benefit. The author is Charles H. Thompson, Associate Professor, Head of the Drafting and Design Dept., The Technical Institute, College of Engineering, Oklahoma State University and copies are available at $3.50 each from John Wiley & Sons., Inc., 440 Fourth Ave., New York 16, N. Y.

SAFETY IN SEWAGE WORKS

"Occupational Hazards in the Operation of Sewage Works," has been completely reviewed by the FSIWA Safety Committee under the chairmanship of John J. Wirts, Superintendent of the Cleveland, Ohio, Easterly Sewage Treatment Plant. The manual gives information on safe operation and maintenance of sewage collection systems and treatment plants. Some suggestions for incorporation by designers are also included. The manual is a 64-page booklet which includes prevention data as well as safe practices, with general summaries of safety recommendations; also report forms for accidents and the evaluation of their causes. Copies from the Federation of Sewage and Industrial Wastes Associations, 4435 Wisconsin Avenue, N. W., Washington 16, D. C., at $1.50 per copy (half-price to Federation members).

INDUSTRIAL WASTE CONFERENCE PAPERS

The Ontario Water Resources Commission's Fifth Industrial Waste Conference, held in May, 1958, was concerned with a variety of subjects, all considered important problems of the Province. These included stream biology; air pollution; and treatment of wastes from refineries, pulp and paper mills, canneries, plating operations, steel mills, and automobile manufacture. To put the finishing touch on a worthy endeavor, the Commission has reproduced the papers, apparently complete as presented. These are assembled as a paper-bound mimeographed publication of 191 pages. Those interested in obtaining copies should write to Dr. Albert E. Berry, General Manager and Chief Engineer, Ontario Water Resources Commission, 235 Gainsborough Rd., Toronto 8, Ontario.

MUNICIPAL SEWAGE TREATMENT NEEDS

Designated PHS Publication 619, this is a companion document to PHS Publication 609, "Statistical Summary of Sewage Works in the United States." In "Municipal Sewage Treatment Needs," John R. Thoman and Kenneth H. Jenkins have summarized the deficiencies in sewage treatment reported by state regulatory agencies in the 1957 Inventory conducted by the Water Supply and Water Pollution Control Program of the Public Health Service. The deficiencies are categorized, under the headings, Replacement of Existing Facilities, Enlargements, Additions, Chlorination, Improved Operation, Connection to Adequate Sewers, New Facilities, and Connections to Adequate Treatment. The data are reported in tabular form in terms of cities and estimated population served by states, drainage basins and population site groups. The data are also reported in terms of percentages. The information has been extrapolated to show new plants needed and the needs by degree of treatment. The bulletin is available from the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C. at a cost of 15 cents.

AIR VOIDS IN CONCRETE AND CHARACTERISTICS OF AGGREGATES

Bulletin 196 contains three papers presented at the 37th Annual Meeting of the Highway Research Board, as follows: "Relationship of Physical Properties of Some Iowa Carbonate Aggregates to Durability of Concrete," by John Lemish, F. Eugene Rush and Carl L. Hiltrop, reports an investigation of Iowa carbonate rocks prepared as aggregates and investigated by petrographic examination; "Correlation Between Concrete Durability and Air-Void Characteristics," by Fulton K. Fears, reports a study of concrete beams fabricated in the laboratory; and "Chemical Characteristics of Some Carbonate Aggregate as Related to Durability of Concrete," by Ramon E. Bisque and John Lemish, includes a summary of results of chemical study of some carbonate rocks, one of which has proven to be definitely unsatisfactory. Copies of Bulletin 196 are $1 each and are available from Highway Research Board, 2101 Constitution, Washington, D. C.

HOW TO DESIGN POLE-TYPE BUILDINGS

This second edition of "How to Design Pole-Type Buildings" has illustrations and text that show how to compute live, dead, wind loads and stresses for every structural member of a proposed pole-type building. An embedment chart, tables and text enable users to make quick, dependable calculations of required pole depths to handle anticipated maximum loads and stresses. Author Donald Patterson presents time-tested procedures for proportioning structural members of pole-type buildings of all sizes and for many different uses. Copies of this 72-page manual cost $1.50 each and are available from American Wood Preservers Institute, 111 West Washington St., Chicago 2, Ill.

HIGHWAY CONSTRUCTION TEACHING AIDS

A "Catalog of Highway Construction Teaching Aids" listing sources of engineering data, descriptive circulars, manuals on operations and applications, motion pictures and models of construction equipment and materials has been published by ARBA. Listed as Technical Bulletin No. 237, it is available at $1 per copy from American Road Builders' Association, World Center Building, Washington 6, D. C. ARBA members in good standing are entitled, upon request, to one free copy of the bulletin.

GROUNDS MAINTENANCE HANDBOOK

This comprehensive volume gives complete information on the maintenance of public, semi-public, industrial and private grounds. Anyone responsible for developing and maintaining such areas will find this book very valuable. Ten chapters treat the following aspects of grounds maintenance: Planning, scheduling and public relations; growing and maintenance of turf; planting and care of trees, shrubs and perennials; equipment maintenance and use; insect and disease control; weeds; soil erosion; maintenance of roads and parking areas; materials specifications; and maintenance of picnic areas. Over 225 drawings, photographs and tables help make this book more easy to use and more instantly meaningful. This second edition by Herbert S. Conover costs $10.75 and is published by F. W. Dodge Corp., 119 West 40th St., New York 18, N. Y.

CONDEMNATION OF PROPERTY FOR HIGHWAY PURPOSES

This report covers three aspects of the condemnation of property for highway purposes; namely, the granting of a court preference to condemnation suits; the right to take possession and/or title to property prior to the final ascertainment of compensation; and the right to remain in possession or take possession for the first time during the pendency of appellate proceedings. Part I, covering the delegation of the power of eminent domain, property which may be taken, legal interest which may be taken and the designation of the procedure to condemn, has already been published. This report was researched and written by Howard G. Feldman, a member of the Highway Laws staff of the Highway Research Board. Copies are $2.40 each and are available from the Highway Research Board, 2101 Constitution Ave., Washington 25, D. C.

THE MODERN JAIL— DESIGN AND EQUIPMENT

This book on the modern jail was written by Roy Casey, an authority in the jail field. Divided into three parts, design, furnishings and operation, the book has complete data in the planning and building of a new jail, the remodeling of an old jail and the day-to-day operation of an existing jail facility. This is an excellent source of information for architects and engineers who might become involved in jail design or remodeling. Copies are $3 each and are available from Roy Casey, P. O. Box 467, Keene, Texas.

ALKALI-AGGREGATE REACTION

Bulletin 171 contains 3 papers sponsored by the HRB Committee on Durability of Concrete—Chemical Aspects, presented at the 36th Annual Meeting. "Evaluation of the Quick Chemical Test for Alkali Reactivity of Concrete Aggregate," by R. C. Mielenz and E. J. Benton, reports experience with the procedure developed in 1945-7 by the Engineering Laboratories, Bureau of Reclamation. "Miscellaneous Observations on the Alkali-Aggregate Reaction and the Ionic Charge on Hydrated Cement," by R. G. Pike and D. Hubbard, describes the results of interferometer and excess ionic charge observations on swelling and shrinking of hydrated cement. "Pressures Developed in Cement Pastes and Mortars by the Alkali-Aggregate Reaction," by R. G. Pike, reports how measurements with a special pressure cell show that by this action pressures in excess of 2,000 psi may be developed. Copies are available from Highway Research Board, 2101 Constitution, Washington, D. C., at 80¢ each.

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ACCEPTING BIDS
for Public Works Equipment

C. M. THELIN,
Public Works Director,
Fort Worth, Texas

ALL MUNICIPALITIES find it necessary to purchase annually a great deal of equipment in order to provide for a certain amount of construction work and for an enormous amount of maintenance work necessitated by the rapid growth of the urban areas. The procedure used in accepting bids for this equipment can make a great deal of difference in the cost of operation and in the public getting value received for expenditures for new equipment. It is, therefore, extremely important and necessary in the maintenance of good government that accepting bids for equipment should be on the basis of certain definite acceptable requirements:

A) Allow for competition among several manufacturers of equipment and do not exclude all but one.

B) Provide for the right type of equipment for handling the job required.

C) Accept the low bid complying with the specifications, unless otherwise justified.

The following general procedure is used by the Public Works Department of the City of Fort Worth in the purchase of equipment such as motor graders, rollers, shovels, front-end loaders, etc.:

1) Determine the size of the machine necessary for the job required. For example in the purchase of a motor grader, we consider whether the machine is mainly for use in alleys, or other similar light work; or for regular maintenance work or for heavy construction work. The specifications are then written around the requirements of a small, medium, or heavy duty machine.

2) Collect the latest data, including the specifications, from the various manufacturers covering the size and type of equipment desired.

3) Determine from the standpoint of maintenance and operation whether a diesel or gasoline powered machine is desired.

4) Write the specifications around the basic data furnished by the manufacturers so as to allow for at least two, and preferably more, companies to bid and meet the specifications.

Courtesy Fort Worth Chamber of Commerce

● **FORTH WORTH, the gateway to West Texas, is shown from the air. In the background is the Trinity River, with its levees, and across the river is North Fort Worth.**

5) State in the specifications that all standard equipment generally furnished with the machine shall be included and then specify what additional equipment is to be included which manufacturers usually list as optional. This list should include filters, gauges, type lubrication, tools, measuring instruments, extra blades, minimum size tube or tubeless tires, etc.

6) Require the bidder to furnish complete detailed specifications of the equipment covered by his proposal.

7) State where equipment is to be delivered with all freight and delivery charges paid to point of delivery. Also, state whether equipment is to be furnished with oil, gasoline and lubrication, ready to operate. Also, request that delivery date and cash discount in fifteen days be shown in the proposal.

8) Specify equipment to be traded in, if any, and where same may be inspected. (Do not change tires or otherwise alter the machine to be traded in after such inspection by the bidder.)

9) The date and time of opening bids should be set by the Purchasing Agent of the City.

10) Specify that the City reserves the right to waive formalities and reject any or all bids and award the contract for the type and make of equipment that it may deem most beneficial to the City.

After the specifications are completed, a requisition and mimeographed copies of the specifications are given to the Purchasing Agent, W. A. Rubottom, who advertises for bids and mails to prospective bidders a copy of the specifications together with information covering when and where bids are to be opened. After bids are received, they are given to the Public Works Department for tabulation which shows all of the items specified and other basic data covering each bid taken from the specifications furnished by the bidder, and prices bid, including net price after trade-in and discount.

After all bids are tabulated and the low bidder determined, the acceptance of same is recommended if the equipment complies with the specifications and is satisfactory. If

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General Contractor: Mary Construction Co., Cape Girardeau, Mo.

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the equipment covered by the low bid does not comply with the specifications, the next higher bid complying with the specifications is recommended for acceptance.

Special Requirements

In rare instances the low bid may comply in every respect with the specifications but cover a make of equipment not known to the Public Works Department. This causes a somewhat difficult situation which is usually resolved by the following procedure:

1) Require that the equipment be demonstrated; or

2) Require a list of similar equipment in service in nearby area; and

3) Write or telephone for information from the owners or operators of such equipment; or, preferably,

4) Inspect the equipment in operation; and also,

5) Determine if repair parts are available for maintenance without undue delays.

If the record of operation is satisfactory, repair parts are readily available and all specifications are met, then we recommend that the low bid be accepted. If these conditions are not satisfactory, then we recommend the acceptance of the next higher bid covering known equipment with satisfactory service and experience and complying with the specifications.

Precautions When Low Bid Is Rejected

A great deal of caution is to be observed when the low bidder is not recommended and all reasons for such recommendations should be completely covered in writing and based upon facts. If this is not done, the way is opened for an argument by the low bidder before the governing body when acceptance of the bid is being considered. It is desirable to inform the low bidder whose equipment is not satisfactory that the recommended purchase is for other equipment and give the reasons why. In most cases when properly informed, they will not contest the award.

The following outline of specifications for the purchase of a motor grader is used by the Public Works Department: Minimum weight; type power unit, i.e., diesel or gasoline; type machine operation, i.e., all-wheel-drive or tandem; speeds, i.e., minimum forward and reverse; controls, hydraulic or mechanical, etc.; tires and tubes; brakes; blade; scarifier; equipment; manufacturer's specifications; delivery; trade-in; discounts; and rights of city.

A summary of acceptance of bids may be considered as follows:

1) Low bid is taken unless:

a. It does not comply with specifications; or

b. Covers equipment which does not show satisfactory operation.

2) Demonstration of equipment required, if an unknown make.

3) Three or more bids are desirable and not less than two required.

4) Individual company service is considered, if bids are close or other factors involved.

Specify clearly what you want, stick to the specifications, and buy on the low bid meeting same unless otherwise definitely justified.

Painting New Jersey Turnpike Bridges

● **STAGING used by typical paint crew on the Turnpike bridge painting project.**

PROTECTION of steel structures along the New Jersey Turnpike present a challenging problem. Weather, fumes from industrial areas and the use of salts in deicing are factors producing major maintenance difficulties.

Through field tests in cooperation with the consulting engineers and New Jersey Turnpike engineers, Corrosion Control Co., New York City, demonstrated that their Butyl coating known as "Rubbatrol" could be used to protect the bridges. A contract for painting both bridges over both the Hackensack and Passaic Rivers, along with some other structures on northern sections of the Turnpike, was extended to enable the contractor to use Rubbatrol. The coating was produced in the standard turnpike color and was applied over the existing surface in a thickness of 5 mils. Other materials such as grease, epoxy and other paint products also are being tested on the bridges.

Rubbatrol can be applied to metal without sandblasting and will withstand very wide temperature variations. It bonds to almost any surface and, because the solvent is mineral spirits, it will not lift off old paint. It provides a flexible and resilient coating, resistant to acids, alkalis and salts and impermeable to water and moisture. In addition to bridge painting, Rubbatrol is utilized for waterproofing and dampproofing of foundation walls and footings and for protection of metal structures such as water tanks and sewage equipment.

The paint contractor on the New Jersey Turnpike job was Wm. G. Pittman Co., Inc., Hackensack, N. J.

• • •

Land Uses and Water Consumption Requirements

(*Continued from page* 124)

larger city, however, although the same procedure can be followed, consideration must be given to the total floor area of the commercial buildings in the block, in order to arrive at a reliable estimate of the probable tonnage of cooling capacity that will be required. This same approach can be used for estimating peak demands.

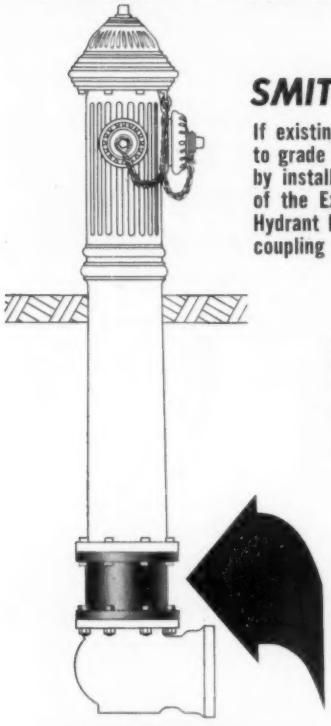
Industrial Water Use

There is no uniformity in water use requirements by industries, even among different plants of the same type. Much depends on in-plant procedures. Major water-using industries in a community can be surveyed separately if it is desired to determine actual or probable water usage. Though

Grade changes caused this.

HERE IS HOW SMITH HYDRANTS CAN BE EXTENDED

If existing Fire Hydrant Nozzles and Caps are not readily accessible due to grade changes this condition can be quickly and economically corrected by installing Hydrant Standpipe Extensions as illustrated. The installation of the Extension will provide clearance between the groundline and the Hydrant Nozzles permitting the free rotation of the wrench and the quick coupling of fire hose to existing Hydrants.



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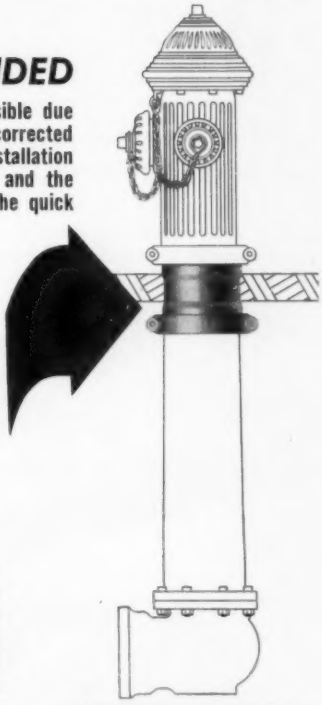
Depth of bury can be increased by installing Standpipe and Main Valve Rod Extensions at the groundline between the Upper and Lower Sections. This construction permits installation of the Extension without excavating and the reuse of the original Hydrant internal operating parts. The Extensions are produced in 6″ increments.

ONE PIECE STANDPIPE OR TWO PART HYDRANT

After the Standpipe is excavated the extension is installed between the bottom of the Standpipe and the Hydrant Elbow. The depth of bury is increased by the desired amount reusing the original operating parts. The Extension thread accepts the original Main Valve Rod assembly. The Extensions are produced in 6″ increments.



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average consumption figures have been derived by many surveys, these are rarely valid for any one community; certainly they should be verified by a survey which should cover probable peak demands as well.

Fire Fighting Requirements

Water used in fire fighting has practically no weight in the total annual consumption of a city. However, the rate of flow during a fire may be so high that it will become the determining factor in the design of pumps, storage facilities and the distribution system, especially in smaller communities.

In designing these parts of the water system, it is customary to determine peak demands by adding the estimated fire flow to the average demand of the maximum day.[28] Several methods have been proposed in order to determine the amount of water that a community requires for fire extinguishing. Of them, the most generally applied is the standard recommended by the National Board of Fire Underwriters, which estimates the required rate of flow for fire in terms of the total population in the community. The total storage of water that a community should provide for fire protection, according to the NBFU requirements, may be estimated on the basis of a 5-hour fire for towns of less than 2,500 persons and a 10-hour fire for larger cities.[29]

Land Development Factors

Forecasting future water requirements for a community requires the consideration of two classes of information:

1. Water Use Data: This includes study of past records; analysis of water use characteristics particular to the locality; determination of present average and peak demands for residential, commercial, industrial, and public uses; analysis of trends affecting the standards of consumption for each of these land uses in order to arrive at more reliable estimates of their future individual requirements; and determination of criteria and policies of adequate water service.

2. Development of the Area: This comprises the delineation of the present and ultimate boundaries of the development area; present and future population to be served by water utilities; distribution of this population in the area; existing land use characteristics; expected amount, location, and density of future land uses; and rates of growth at different stages of development of the area.

After discussing present day water consumption and the continuous change in requirements that has been observed during the last decades, it becomes evident that today's standards are not entirely suitable for application to expected growth in population and expansion of land uses in a community in order to estimate future water demands. It is reasonable to assume that trends toward increased water use rates will remain for the various land uses, but it is difficult to make predictions as to the quantitative changes that can be expected to take place in present day figures.

In general, there is little information available relating estimates of future requirements to land use characteristics in a city, probably due to the difficulty of separating the demands for each individual use. It is felt, however, that separate forecasts should be made for residential, commercial, industrial, and public uses, because of the different characteristics of each use. Estimates for residential consumption can be properly expressed in gallons per capita per day, but it has

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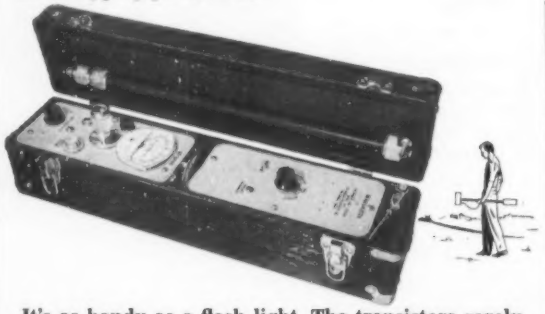

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been already stated that this unit is far less meaningful for non-residential land uses which are not so closely related to population. Commercial and industrial consumption may be more adequately measured on a floor-area and a land area basis, which at the same time would also facilitate their application to land use analyses made by the city planner.

A study made by Wolff for predominantly residential areas in the Middle Atlantic States concluded that an annual increase of 2 percent per capita per day may be reasonable for the design of residential systems during the period 1955-1975.[30] This percentage rate of increase is recommended by Wolff rather than a fixed incremental quantity per year because it reflects more accurately the characteristics of consumption of individual areas.

In estimating maximum-hour demands, however, it is important to determine what policies are going to be followed regarding standards of adequate customer service, mainly in areas with growing air conditioning and lawn sprinkling demands. If the community is going to restrict unreasonably high demands by means of regulations and surcharges, maximum hour rates would be much lower than if a liberal policy is adopted. For instance, the California Water Supply Standards require that: "The quantity of water delivered . . . should be sufficient to supply adequately . . . the total water requirements of all consumers under maximum consumption."[31] Naturally, under such standards of quantity, very high peak hour rates may be reached.

Misleading estimates are likely to result if figures developed for one locality and applied to another are used without judgment of local characteristics and trends. For this reason, it is recommended that every city should carry a complete year-by-year record of water use, reporting the breakdown of consumption for each individual land use.

Commercial water requirements for sanitary and service purposes are low compared with other uses, and have received little attention in water use analyses. From the information available, no significant changes in consumption rates have been reported in many years. However, the trend toward increased installation of air conditioning systems has made commercial demands important, especially regarding peak water rates.

Forecasts of future commercial consumption may assume that standards for sanitary and service use per unit of floor area will remain unchanged, but provision should be made to anticipate the expected growth of air conditioning, depending on the severity of climatic conditions in the locality during summer. Once again, the determination of policies will be the base for estimating future requirements. If conservation practices are enforced, water demands will be much lower than they would if non-conserved types of units were allowed to be installed. Rates of water use for air conditioning are generally related to tonnage of installed capacity, but since tonnage depends on the amount of floor area, it results that water use for air conditioning purposes can be ascertained from estimates of commercial floor area and the proportion of it which will be air conditioned.

Future industrial requirements are perhaps the most uncertain among all land uses, due to the range of variability for different kinds of industries. In order to forecast future industrial loads, it seems

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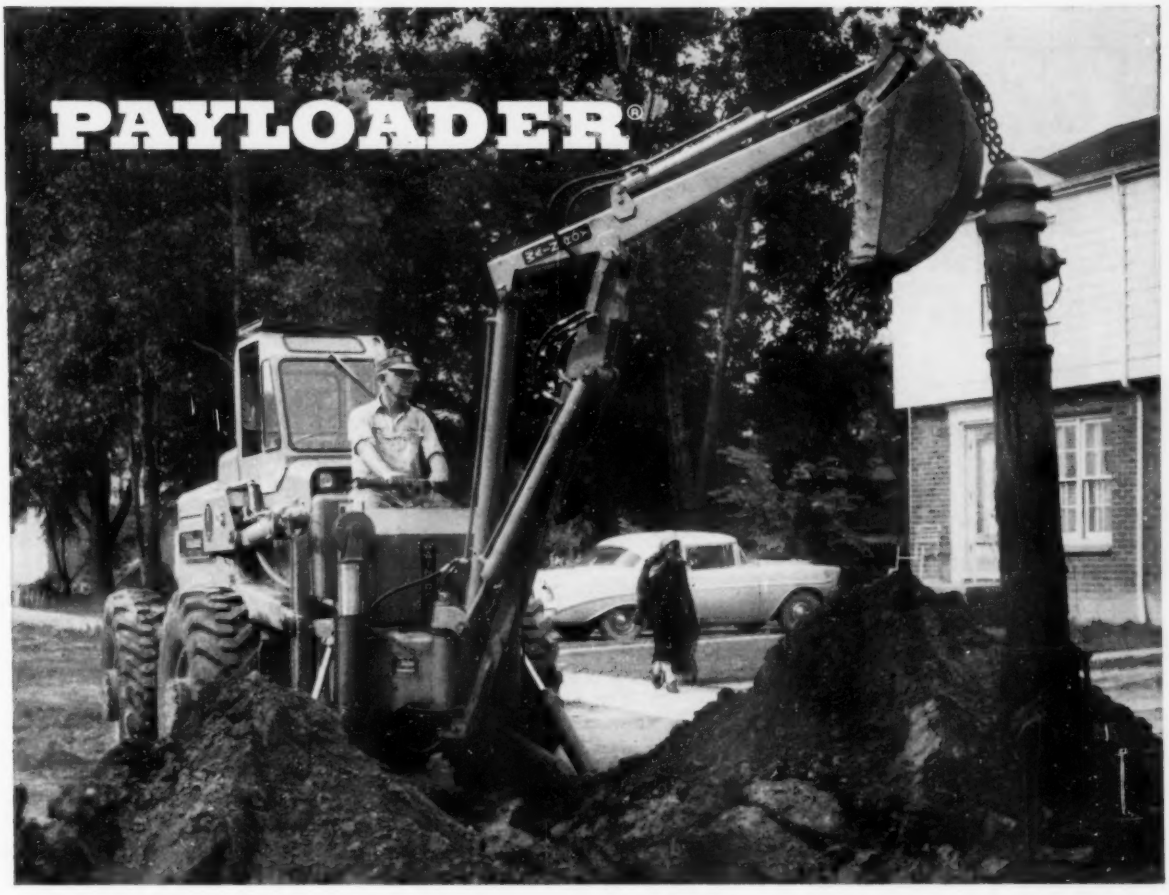

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more convenient to separate the estimates for existing establishments from those for new industries that may come into the area. The amount of water that the existing industries will require can be projected from surveys of the individual consumption by each customer, which generally can make a better estimate based on expected future levels of production and amount of water needed per unit product.

The Land Development Plan

The land development plan is an analytical study of the future changes that will take place in the city based on the existing conditions and significant trends in the urban area. Studies of the economic base, employment and population, which provide measures of the growth potential, and analysis of the existing land use characteristics will provide the planner with a basis for estimating the future space that will be required to accommodate the expansion anticipated during the "planning period," and also the location that the various land uses will have within the "planning area."

Forecasting space requirements for each land use category will allow the engineer to determine the future total water demands for which the capacities of the reservoir, intake, treatment plant, storage, and main pumps are to be designed. Knowledge of the future location of land uses will be indispensable for designing the distribution system more adequately.

In order to implement a long-range plan for water works, the need for unified control of water service in the city and fringe is apparent, since the utilities must be extended beyond the political boundaries of the city. It also appears advisable that the water supply should be a municipal utility and as such an integral part of city government.[32] This would centralize the planning, financing, and construction of water works, allowing a better coordination of these three phases of the projects under a single administrative authority. In addition, designing for ultimate development requires the expenditure of large sums that will not be recoverable for many years. While this is acceptable for the municipal government, it will generally be an objectionable investment for privately owned utilities.

The land development plan will also enable the city to prepare a long term capital improvement program for the expansion of water facilities by forecasting when extensions or additions to the system will become necessary. On this basis, a list of priorities may be prepared and funds reserved at the proper time.

Finally, consideration should be given to the total water needs for ultimate development of the community in terms of the availability of water resources in the area. In regions where water is not abundant, it may be possible that the estimated future total consumption will exceed the amount of water which can be made available to the city economically. This would limit the use of water for irrigation and industrial purposes, and eventually determine the ultimate growth of the community.

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H. A. RADZIKOWSKI, Chief
Division of Development,
and
JOHN J. LAING, Chief,
Road Equipment Branch,
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AN EQUIPMENT performance specification is one based principally on a machine's ability to accomplish certain functions relating to work methods and to perform actual or simulated tasks to established minimum requirements. Compliance with performance specifications must be based on controlled tests. Performance specifications are largely the buyer's specifications by which he stipulates the quality and quantity of work accomplishment expected from the machine.

On the other hand the manufacturer's, or seller's, specification is composed largely of items which describe or give a word picture of the physical characteristics of the equipment and occasionally include some functional or performance information.

Performance specifications normally include many of the physical characteristic items, principally those which have a bearing on machine accomplishment, such as weight, dimensions, etc., but the dominant requirements on which acceptance or rejection will be largely based relate to its actual ability to perform.

The Bureau of Public Roads is preparing a specification on motor graders at the request of the General Services Administration which is responsible for the procurement standards and procedure used by Federal agencies. Some of the general features of the Proposed Interim Specification on motor graders follow.

In order to relate specific requirements to a given size and drive types pending the development of tractive effort information, the preliminary size classification shown in Table 1 was developed.

The net brake horsepower rating shall be as specified in Table 1 for intermittent duty based on engine performance with such engine accessories as are necessary for motor grader application. Intermittent brake horsepower ratings are intended as maximum allowable net outputs for periods of continuous operations up to one hour. Grader manufacturers shall furnish certified net horsepower output curves for standard sea level conditions of 29.92 inches barometric pressure 60°F. air temperature prior to motor grader qualification tests.

Type I machines are 6-wheel 4-wheel drive; Type II are 4-wheel 4-wheel drive; and Type III are 6-wheel 6-wheel drive.

The general service requirements provide for complete moldboard rotation on sizes G-2 through G-6 to enable grading in either forward or reverse. The general character of the types of work to be performed under various soil conditions and highway geometrics are also listed. These requirements also define the normal range of operation as being from sea level to 5,000 feet above and the efficiency of operation expected at the higher level. Above 5,000 feet, greater consideration must be given to engine design and capacity since 4-cycle naturally aspirated engines lose 3 percent of their power for every 1,000-foot

Table 1—Preliminary Size Classification

Size	Minimum Weight with Scarifier (lbs)			Certified Min. Net Engine HP at Full Load Gov. Speed	Min. Wheel Base
	Type I	Type II	Type III		
G-1	9,500			45	13 ft. 11 in.
G-2	14,250			55	16 ft. 6 in.
G-3	21,250			75	18 ft. 9 in.
G-4	23,000	17,750	19,750	100	18 ft. 9 in.
G-5	23,750	22,000	24,000	115	18 ft. 9 in.
G-6	28,250	25,750	30,750	130	18 ft. 11 in.

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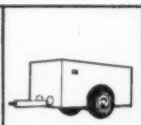

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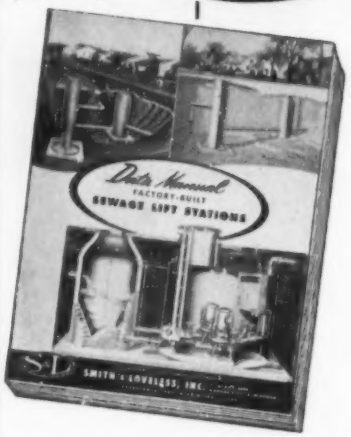

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rise in elevation. At higher elevations, 8,000 to 12,000 feet above sea level, there is a problem of controlling turbocharger speeds on engines so equipped.

For Federal procurement purposes all motor grader makes and models which have been tested for adherence to performance requirements and found acceptable will be placed on a Qualified Products List. Federal agencies will draw from this list in obtaining bids. Minor changes by the manufacturer will be certified from time to time by the Bureau of Public Roads. This general procedure results in the elimination of field testing by individual agencies and the simplification of inspection at time of production and delivery on a procurement lot. Successful bidders will be required to certify that the model or models offered in the bid are identical with the model or models on which acceptable qualifying tests have been performed.

A pretest examination is made of each motor grader to determine conformance to important physical requirements of the specifications and to prepare an accurate description of the model tested. In recording descriptive data, special attention was given to the components which were not made by the grader manufacturer. For items like filters, generator starter, etc., the type, make and model were noted along with available serial numbers. In addition to listing component details, photographs of the test models were taken from several angles. The pretest examination is made without the engine running and includes such items as: Dimensions; weight; engine and accessories; cooling system; transmission; final drive; front axle; brakes; controls, etc.

Tractive Effort Performance

The first and most important performance requirement is that for reserve tractive effort. Each size and type of grader must provide a required blade pull in each forward gear while operating at maximum power speed over a dry level concrete surface.

The question is often asked: Why are the tractive effort tests run on a concrete surface? With only minor exceptions, operation on a concrete surface does not represent a working condition, but concrete is used because tests of this nature must be uniform and subject to repeatability. It would be practically impossible to obtain uniformity and repeatability on an earth test course because of the wide difference in moisture content, density and cohesiveness of soils. Concrete surfaces, on the other hand, offer a uniform surface texture with consistent coefficient of friction when dry. Our original test procedure called for six test runs, three in each longitudinal direction of the test course, with an average of the best four (two in each direction) used in reporting performance. These runs were to be made at full load governed speeds as published or furnished by the manufacturer.

The first models tested were equipped with torque converters, and it was soon apparent that operation at manufacturer's rated engine speed would not provide the point at which maximum power occurred. The maximum power torque converter drives may vary from 50 to 100 rpm from the manufacturer's rated engine speed. The decision was then reached to determine the point of maximum power in each gear for both torque converter and friction clutch transmission by a series of drawbar pulls. On torque converter models the range of test runs varied from a point above rated engine speed to converter stall and on friction clutch machines from a point above rated engine speed through the torque range. In the case of torque converters, it was found impractical to control the test by engine speeds since there was no direct relationship with ground speeds. Good results were obtained in controlling the tests on the torque converter models by varying the loads and recording, and the same procedure was used on the friction clutch models. Tractive force curves which reflect the torque characteristics of the engine and power train were plotted from the drawbar runs (blade pull vs. ground speed) and the approximate point of maximum power computed from the formula:

$$\text{Blade horsepower} = \frac{\text{Pull in pounds} \times \text{mph}}{375}$$

with the ground speed held at the point of maximum power, four additional confirming runs, two in each direction, and of a minimum 30 seconds in duration, were taken and plotted on the tractive force graphs. From these five points a very dependable value for the blade pull at maximum power was obtained for each gear. The average blade pull readings at the point of maximum power become a point on the tractive effort curve for the respective gear.

The engine shall operate under

load at maximum power speed and at full throttle without smoke in excess of No. 2 as described in Military Specification MIL-E-11278B. This requirement was included to provide an indication of fuel consumption efficiency and to determine the possible effect of oversize fuel injectors.

The cooling system shall be capable of providing an ambient air to water out temperature of not more than 90°F. at the ambient temperature prevailing during the work performance tests.

The master clutch requirements provide for a static torque capacity of not less than 100 percent above the maximum engine torque. Manufacturers certification is acceptable for this item.

The transmission requirements for the friction clutch types provide for an acceptable maximum working speed range in the first three forward gears and a minimum travel speed (for transfer between jobs) in high gear. Working speeds are those attained under load at maximum power conditions and are verified in the tractive effort test. Minimum high gear speed is determined on a level paved surface at full throttle under no load conditions.

Requirements for front axles on Type I graders provide for leaning front wheels up to at least 15° right and left of the vertical. Present thinking is that this requirement will be revised to provide a lean of 18° to 20° on the larger machines. Adequate wheel lean prevents scarring of the ditch sides, permits riding on the slope and shortens the turning radius. Wheel lean is measured in the functional tests with the machine located on a level surface and the engine running.

The service brakes must be capable of stopping the grader from a speed of 15 mph within 25 feet on a dry, smooth, level concrete surface. The test provides for six test runs, and stops, all of which must be within the prescribed limits.

The parking brake must be capable of holding the grader wheels on a 20 percent slope. Coefficient of friction of the test course is assumed to be sufficient to allow the machine to stop and remain at rest. In making the test the grader is headed in both an uphill and downhill position.

Controls

The specification provides that controls for steering and operating the various parts of the grader shall be either the hydraulic type or power-operated mechanical type on all

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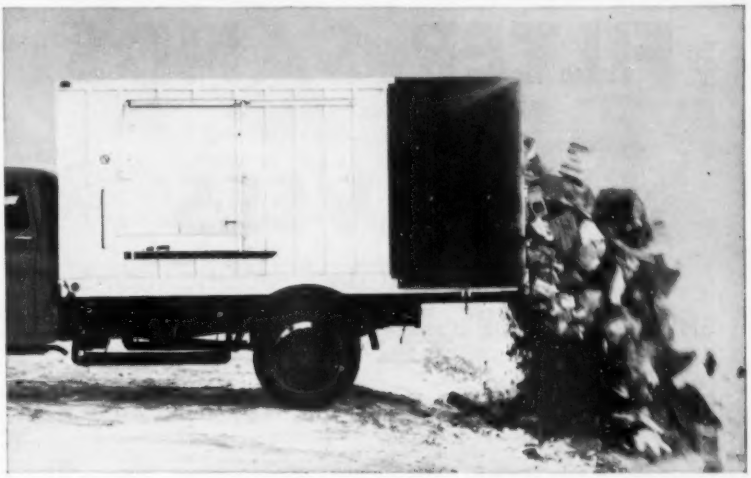

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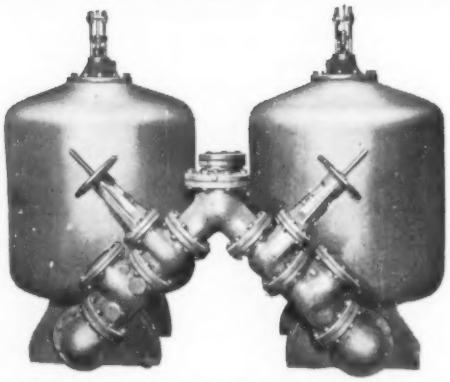

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sizes except G-1 and G-2 which may be of the straight mechanical type. Efficiency of operation, particularly in the larger sizes, requires power-operated movement of the functional parts. Beginning with size G-3, the front tire sizes are such as to require power steering. Independent power for steering is an ipso facto requirement in view of the safety provision that the steering must be designed for manual operation in the event of failure of the power steering system.

The final specification will also provide that similar controls for each side of the grader and in both directions shall be approximately the same operating speed. This requirement such as for raising and lowering the moldboard is important for machine maneuverability and avoidance of lost time. Control requirements are checked during the functional tests with the grader located on a smooth level surface with the engine running. Speed of controls are measured from the beginning to end of their travel in "inches per minute."

Moldboard Assembly

The overall performance of a motor grader depends on the maneuverability and working ranges which are built into the moldboard assembly. The normal operating range of a grader moldboard should be such that an operator will be able to shift the blade for most routine work positions without leaving his quarters or without advice from a second party as to the relationship between the blade and other parts of the grader during the movements. This requirement is particularly important in maintenance operations, since it is the practice of many highway departments to work motor grader operators as a one-man patrol.

In order to obtain a smooth cut at the bottom of a slope and thereby minimize erosion, the specification requires that for all bank sloping positions of 45° or more the lower point of the blade at ground level be at or outside of the tire line. If the blade is inside the tire line, it is necessary to place the wheels on the slope.

A bank cutting angle of 90° (R&L) is specified for grader sizes G-1 through G-6. Some minor revision of this requirement may be necessary, since some models cannot obtain the full 90° on both sides. Except in loess soils a 90° slope is seldom used in highway work, but our general service requirement covers all soil conditions. The over-

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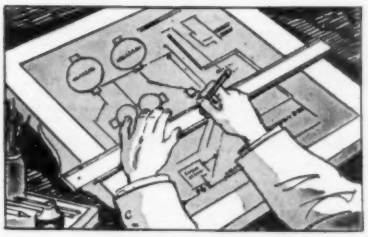

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all reach of the blade as measured by its vertical projections from the ground line is an important functional characteristic for bank sloping angles of both 90° and 45° and is being measured in the tests.

The minimum cut below ground level and the minimum lift above ground level of the cutting edge are requirements indicative of work potential and ease of travel in rough terrain, respectively.

Adequate blade reach outside of the tire line is one of the most important functional requirements for the moldboard assembly, especially for highway maintenance purposes. In its present form the specification calls for a minimum blade reach of 6′ 0″ in sizes G-4 through G-6 and a range of 3′ 6″ to 5′ 9″ for sizes G-1 through G-3. The several moldboard assembly requirements just described are checked during the functional tests with the engine running.

Performance of Typical Grading Tasks

Each grader tested was subjected to approximately 3 1/3 hours of typical work as follows: Ditching, 50 minutes; coarse grading, 50 minutes; scarifying, 20 minutes; windrowing, 30 minutes; spreading, 30 minutes; and fine grading, 40 minutes.

The purpose of these tests was twofold: 1) To test the efficiency of the cooling system under actual work conditions; and 2) to accumulate a sizeable amount of quantitative data for various motor grader operations for possible use in developing additional performance criteria. It was realized that there would be moisture and density variables to be resolved from the clay-gravel test course which was selected, but material sampling during each test might make it possible to develop some broad guides of performance. Since there is a marked dearth of such actual performance data for motor graders, it was deemed advisable to gain some first hand experience in a new equipment testing area. One interesting aspect of the work performance tests was that each manufacturer furnished his most capable machine operator so that by minimizing the human factor actual production was at or near maximum for the prevailing test conditions.

These tests, along with the reserve tractive effort tests, also provided a measure for comparing the relative performance of machines having different power transmission systems under reasonably controlled test conditions.

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The test course was laid out in the shape of a rectangle 400 feet (net) in length and about 180 feet wide. In measuring production time both the gross time, including turning movement, and the net time, i.e., the forward grading on the 400-foot section, were measured. Production was measured in terms of trips, linear feet, cubic yards or square yards. The sequence of operations permitted the operator to restore the test course to nearly its original cross section, after which it was recompacted for succeeding tests with a 50-ton pneumatic tired compactor. Surface density was measured just prior to the tests as was moisture at the surface and at ½-cut depth.

In the scarifying test, alternate scarifier teeth were removed to permit a ready penetration of approximately 6 inches.

In addition to the tests involving quantitative data, graders in the G-2 through G-6 sizes were given a bank sloping test of approximately 40 minutes duration. In this test the ability of the grader to cut even slopes of 1:1 and 1½:1 with transition between was observed. Also checked was the effect on slope quality produced by graders which were unable to shift the lower point of the blade even with or outside the tire line.

The specification provides that when torque converters ar furnished, the converter shall have a torque multiplication ratio of not less than 2.0 to 1 and adequate means of cooling. The lowest torque multiplication now furnished on graders is 2.5 to 1, but there is no reason why a 2 to 1 ratio would not suffice with proper matching of converter with engine. The adequacy of the cooling system for torque converter machines is quite important because of the additional heat generated by reversing the flow of oil in the converter.

When cab heaters are required, the specification provides for the hot water type having a minimum heating capacity of not less than 12,000 Btu's per hour. Certification from the manufacturer is accepted for this performance requirement.

When bulldozers are required as an attachment, the specification provides that the blade shall have a lift above ground of not less than 15 inches and a cut below ground of not less than 6 inches. Tests to confirm these functional requirements are made at the factory.

Provisions are made in the specification for both V-snowplows and wing attachments. In the case

of the snowplow wings, certain functional requirements are specified which are essential to the efficient operation of the combination. The specification provides that adjustable arms shall be provided for setting the horizontal angle of the wings to at least the angle the V-plow makes with the horizontal axis of the grader. Also, that the height of the outer edge of the wing shall be adjustable from 0 feet to 8 feet above the ground line and the height of the inner edge from 0 feet to 3 feet above ground line. The range permits the winging back of snow either at shoulder grade or a point above guard rails. Tests for these functional requirements are made at the factory.

Some of the Federal agencies which operate motor graders in mountainous terrain believe that turning radii of the grader, both interior and exterior, are important provisions for their special service requirements. Under some alinement conditions for single lane roads, the difference between the inner and outer radii will determine the width of bridge needed for passage of the grader.

This is the first time an effort has been made to set up comprehensive qualifying tests for a major item of equipment, and although the testing job is not yet complete, many apparent benefits have already been realized and others are bound to accrue in the future.

It appears that public highway departments can benefit both directly and indirectly from the Interim Federal Specification for motor graders. If they use the same approach to the procurement problems, they are bound to receive an improved end product.

The preparation of the Interim Federal Specification for motor graders, including the development of performance criteria and test procedures, required cooperative effort: and that received from the motor grader industry was most gratifying. Considerable credit is also due to other Federal agencies and particularly the General Services Administration and the Corps of Engineers, U. S. Army. We are especially indebted to the Evaluation Engineering Branch of the Engineer Research and Development Laboratories, Fort Belvoir, Virginia, for the thoroughness and technical skill displayed in conducting the motor grader tests.

This paper, slightly condensed here, was presented at the meeting of the American Association of State Highway Officials, in San Francisco, Calif.

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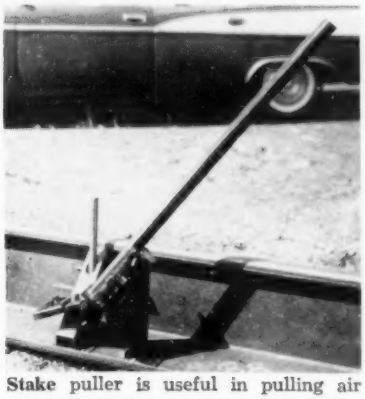


Stake puller is useful in pulling air strip and highway paving form stakes

A post puller that weighs only 33 lbs. but exerts 15,000 lb. pull is available from Holland Mfg. To make the tool more versatile, an adjustable fulcrum has been designed into it. When the fulcrum is set in the notch nearest the jaw, the tool has the greatest power and the shortest lift. The stake puller enables fewer men to do the work in less time and with no stake mutilation. The puller can be used for all steel stakes — round, angle, tee, channel or flat. It also handles wooden stakes, round or square, and steel pipe or rods ¼ to 2½ ins. in diameter. For full details write Holland Mfg. Co., 920—15th Ave., East Moline, Ill., or circle **No. 4-1** on the reply card.

Lightweight Asphalt Paver

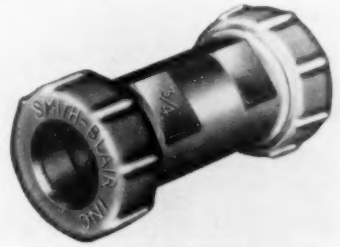
A new model asphalt and base paver, known as the Watson-Cmetco Rola Paver is announced. This paver paves and rolls on its own wheels while being pulled and fed by a dump truck. The Model 1A-208 weighs 900 lbs. It can be used in congested or narrow urban areas, and can be easily transported on city streets to and from the job. During transport, the unit hangs on the dump body tailgate. More information from Cmetco Division, H. S. Watson Co., 1316—67th St., Emeryville 8, Calif., or circle **No. 4-2** on the reply card.

Trencher for Service Lines

The Charles Machine Works announces the Model M-3 Ditch Witch trencher. New features of the unit include all-riveted 20,000-lb. test digging chain, telescoping digging boom to provide correct boom length for every job and new planetary gear reduction unit. Standard equipment includes a three piece telescoping boom to provide selection of 2, 3, 4 or 5-ft. boom; a three piece digging chain for depths of 2, 3, or 4 ft.; and a complete selection of digging teeth to cut a trench 3, 4, 6 or 8 ins. wide. For more details write the Charles Machine Works, Inc., 684B St., Perry, Okla., or circle **No. 4-3** on the reply card.

Compression Couplings

Smith-Blair announces a complete line of compression couplings for joining ½-in. through 2-in. iron pipe. The couplings have high grade cast malleable iron sleeves and end nuts, and are standard equipment with wedge-type rubber gaskets. Their overall features are ease of installation and disassembly, a maximum of flexibility, and the incorporation of big coupling principles of design. The gaskets are of beveled construction so that they draw normally and naturally around the pipe. A friction ring prevents gasket scuffing and makes tightening easy. The couplings are furnished in short sleeve lengths, Type 511, and in long sleeve lengths, Type 512, and they are painted with a rust inhibiting blue lacquer, or galvanized finish as standard. Complete data from Smith-Blair, Inc., 535 Railroad Ave., So. San Francisco, Calif., or circle **No. 4-4** on the reply card.



These couplings are easy to assemble

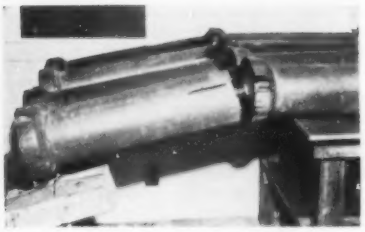
Pest control feeder is automatic and is adaptable for fast or slow feeding

Poison Feeder to Control Rats and Mice

A new poison feeder made of clear plastic for controlling rats and mice is announced by 3-Way Co. Called the 3-Way rodent feeder, its unique construction makes accidental spilling of deadly poisons impossible. Children, pets and livestock are completely safe when it is used. Adaptable for either fast or slow feeding of liquid poisons or dry types of poison, it is completely automatic, being regulated by atmospheric pressure. More details from the 3-Way Co., Box 242, Vacaville, Calif., or circle **No. 4-5** on the reply card.

Electric Plants for Stand-By Power

A series of bigger capacity electric plants to meet the demands of heavier stand-by power requirements is announced by Kohler. The new plant is the model 75R81, a 75 KW, 120/208 volt AC electric plant equipped for remote starting. It is adaptable to practically all applications and voltage requirements and features a 12-lead reconnectable revolving field with direct connected exciter. The plant is electrically cranked with an automotive-type 12-volt starting battery. The 6-cylinder engine develops 220 hp at 1800 rpm and is of heavy-duty design. Standard equipment includes vibro dampers, low oil pressure and high water temperature safety devices, dual type oil filters, oil pressure gauge, muffler and oil bath cleaner. More details from Kohler Co., Kohler, Wis., or circle **No. 4-6** on the reply card.



Root-proof sewer pipe with Root-Seal

Hot Pour Plastic Base Sewer Pipe Jointing Compound

Root-Seal, a hot-pour mineral filled pliable plastic base compound, is used to watertight and root-proof sewer pipe. The application of the compound is easy. Brush-apply root-seal primer only on joint surfaces that are likely to be dusty or wet at time of laying, applying at least 24 hrs. before laying pipe. Chop the Root-Seal compound into small pieces and melt in a melting kettle. When the pipe has been installed, pack joint with dry twisted unoiled jute of sufficient diameter and thickness to center the pipe. Place an asbestos or rubber runner of suitable diameter and length moistened with puddled clay around the pipe at the bell, then clamp at the top, slightly off center, leaving a V-shaped opening in which to pour the Root-Seal. Joint runners should remain in place until joint has cooled. For full details write K. T. Snyder Co., 4101 San Jacinto, Houston 4, Tex., or circle **No. 4-7** on the reply card.

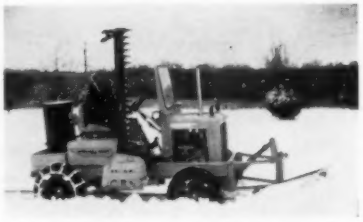
New Transit Crane Announced by Bucyrus-Erie

A new 45-ton Model 30-B transit crane has been announced by Bucyrus-Erie. The crane can lift a maximum load of 45 tons with a 40-ft. boom at a radius of 15 ft. The machine can be used as a 1 to 1½-yd. hoe, 1 to 1¾-yd. shovel, 1 to 1½-yd. dragline and as a clamshell. The unit which will reach 140 ft. with jib, has a boom fabricated of Tri-Ten steel, featuring extra strong chord angles and larger cross sections. New features include: An air-operated boom hoist and engine master clutch to complement the air-control system; adjustable cone rollers; and a 6 x 4 or 8 x 4 carrier with gas or diesel engine. Also featured are a two-speed gear box, single-piece counterweight, heavier A-frame, hydraulic jacks, and for machines with torque converters, two-lever dual governor control. For more details write Bucyrus-Erie Co., South Milwaukee, Wisc., or circle **No. 4-8** on the reply card.

Aggregate Spreader Controls Material Flow

The Hi-Way Model "R" spreader is a positive feed aggregate spreader which controls material flow in either forward or reverse and is designed particularly for seal coating. The spreader is being made in six standard sizes which spread in widths from 8 to 13 ft., being fully interchangeable with different dump bodies. Featur include a feedgate which follows a true arc when opening or closing, thus eliminating wasteful free flow of material; a single shift, three-position lever which controls the agitator and feed roller and which returns automatically to neutral in the event of a shifting error; adjustable feedgate levers, mounted at both ends of the spreader, which permit tapered spreads when desired; and a swivel-type, self-coupling, adjustable spreader hitch that can be raised and lowered by crank to fit any truck height. Complete information by writing Highway Equipment Co., 616 D Ave., N.W., Cedar Rapids, Ia., or circling **No. 4-9** on the reply card.

Year Around Usability of Topeka Mower

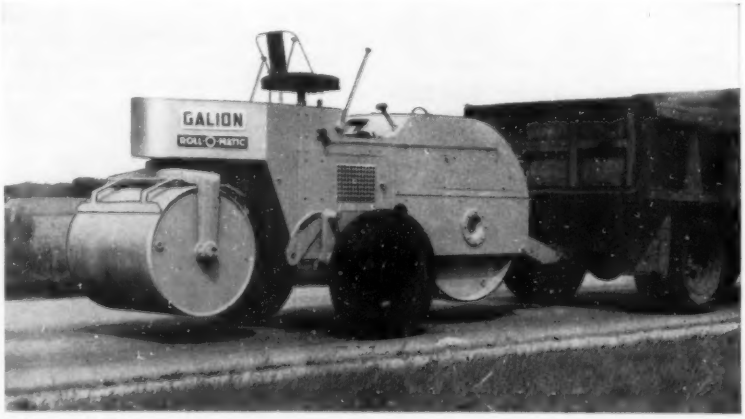


Unit travels up to 40 miles per hour

The addition of an angle-dozer attachment enables the Topeka Mower to clear snow from streets, sidewalks, parks and access areas. The dozer angles 30° right or left and also works in a straight position. The blade is 72 ins. wide, with replaceable cutting edge. It is hydraulically raised and lowered and has a 14-in. clearance in maximum raised position. The unit has travel speeds up to 40 mph. For further details write Topeka Hiway Mower, Inc., 623 East 7th St., P. O. Box 720, Topeka, Kans., or circle **No. 4-10** on the reply card.

Roll-O-Matic Retractable Wheel Tandem Roller

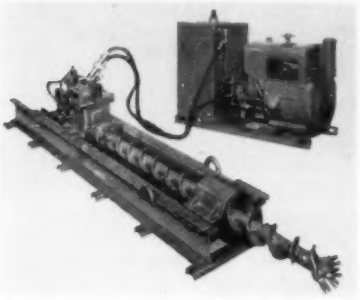
Galion's new 4-6 ton retractable wheel tandem roller is supplied with Roll-O-Matic drive. This roller is designed to work faster, operate easier, roll to closer clearance, and transport more quickly than ever before. The Roll-O-Matic drive is a highly efficient combination of torque converter, automatic fluid transmission, and tail-shaft governor by means of which the rolling power is automatically increased or decreased as needed. Rolling speeds from 0.5 to 5.6 mph are provided by a two-range transmission. The roller is quickly transported by towing it from job to job on its own pneumatic wheels which are raised or lowered by hydraulic power. The two-tongue with pintle hitch is raised or lowered by a separate built-in hydraulic cylinder. Other features include extra-large ballastable rolls, hydraulic steering, dual controls, spur gear final drive enclosed in oil-tight housing, and water-cooled 32-hp (at 2400 rpm) gasoline engine. Contractors and state, county, and city road and street maintenance crews should find this an exceptionally useful roller. For complete data write The Galion Iron Works & Mfg. Co., Galion, O., or circle **No. 4-11.**



Galion roller is quickly transported from job-to-job on its pneumatic tires

New Line of Trench Drills

A complete new line of trench drills which permit drilling for and laying pipe without breaking the pavement, disturbing the surface or disrupting traffic has been introduced by Salem Tool. The units have drilled and pushed pipe as far as 250 feet and are limited only by pipe weight and earth or rock formations to be drilled. The drill is placed in the trench with a sideboom tractor or a truck-mounted winch. The auger rotates inside the pipe and advances the pipe as the hole is drilled, the pipe being pushed simultaneously. Model 10-D, the



Lay pipe without disrupting traffic

smallest unit, has a separate gasoline power supply unit which can be operated from the ground or left on the truck. It will handle augers up to 10 ins. in diameter. Models 16-TD and 24-TD will handle augers up to 16 and 24 ins. in diameter. Power units on these drills are an integral part of the machine and are gasoline operated. Carriage speed of the 16-TD is from 0 to 40 fpm. The 24-TD has a speed range of 0 to 6.5 fpm and both units have four-speed transmissions and start electrically. Details on all drills from The Salem Tool Co., Salem, Ohio, or circle **No. 4-12** on the reply card.

Asphalt Finishers on Crawlers or Pneumatic Tires

Designed throughout to new standards of heavy duty, high capacity, low maintenance operation, Barber-Greene has announced two new asphalt finishers, the Model SA-60, which is mounted on special high speed tractor-type crawlers; and the Model SB-60 which features a revolutionary pneumatic tire mounting. Both models offer a selection of speeds from 14 fpm to 12 mph, in both forward and reverse. On both models, the wheels or crawlers are in-set well within the machine's normal laying width to facilitate matching joints, working next to curbs, etc. Both crawler mounted and rubber tired models

Barber-Greene pneumatic tired finisher in travel position. Feeder is supported by idler crawlers when paving

are steered by a wheel which can be turned easily with one hand under any paving or traveling condition. The hopper design relies neither on increased height nor width, but rather, on its ability to get the load of mix away from the truck more quickly. Positioned in the spreading screw chamber, are adjustable feelers which control the electric feeder and screw clutches. These feelers may be positioned at any point in the spreading screw chamber, to compensate for such factors as abnormal arching of mix. The crawler mounted SA-60 may be converted to the rubber tired SB-60 and vice versa. Complete information on both finishers from Barber-Greene Co., Aurora, Ill., or by circling **No. 4-13** on the reply card.

Davis 99 Economy Loader

The Davis 99 economy loader announced by Massey-Ferguson has a capacity of 2,000 lbs. at half height and 1,500 lbs. at full height. It is available for the M-F Work Bull 202 and all utility models of Massey-Ferguson or Ferguson tractors, as well as those of Ford, International Harvester, Allis Chalmers and Oliver. It has a 10-gpm pump and an operating pressure of 2,150 psi. The lift arms have a breakaway power of 2,500 pounds. The single dump cylinder is double-acting, with hydraulic pressure both ways. The bucket has a 10-ft. clearance, and it will reach a maximum of 56 inches in front of the tractor. For more details write Massey-Ferguson Industrial Div., 1009 So. West St., Wichita, Kans., or circle **No. 4-14** on the reply card.

Precision Slurry Feeder

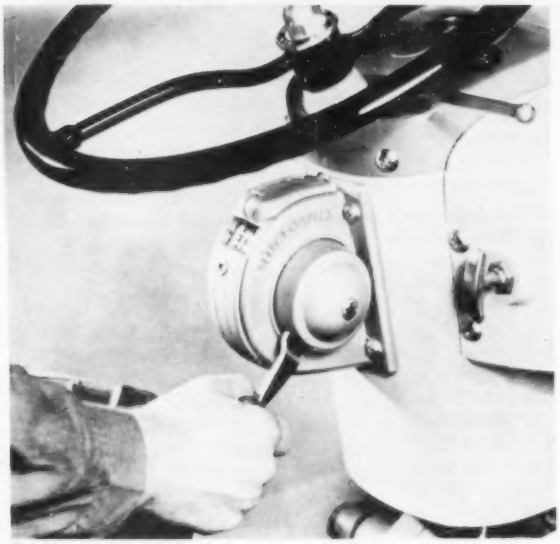
The Model 600 slurry feeder designed specifically for diatomaceous earth slurries is introduced by Precision Chemical. Now all chemical feeding requirements, such as the addition of chlorine and sulfuric acid, may be combined in one pump by the addition of independently controlled heads. Designed for highly abrasive filter-aid and corrosive chemical slurries, the heavy-duty, positive displacement pumps incorporate a unique flush arrangement. An automatically controlled clear water flush system, integral with the pump, assures pumping dependability over the full output range of 0-2.5 gph. More details from Precision Chemical Pump Corp., 1396 Main St., Waltham, Mass., or circle **No. 4-15** on the reply card.

Roller Attachment for Cat Grader

Operating adjustments are made from the operator's platform on the grader

The GraderroleR, a road surfacing roller attachment for Caterpillar No. 12 and 112 motor graders, is announced by the Martin Co. The attachment is raised and lowered by hydraulic power and by using the weight of the grader, it can exert up to 225 lb. of compaction pressure per linear inch over its 42-in. roll width. To match the roller angle of operation to the slope of the road, the roll is pivoted at the center and follows the road surface, regardless of the position of the grader. All operating adjustments can be made from the operator's platform. The unit is equipped with spring tensioned scraper blades and a 35-gal. automatic sprinkling system to keep the asphalt from sticking to the roller. The roller is used for all kinds of rolling when building new roads or repairing old ones. More details from the Martin Co., Kewanee, Ill., or circle **No. 4-16** on the reply card.

New Type Transmission



Ford's tractor transmission is controlled by just one lever

A totally new type of tractor transmission which can be shifted "on-the-go" without the use of a clutch pedal and which has 10 forward and two reverse speeds is announced by Ford. Versatility of the transmission for industrial applications is one of its great advantages. Shifting from any gear to any other gear is a simple matter of "dialing" the desired gear ratio with a small hand-controlled lever just below the steering wheel. Gear-driven at all times, the Select-O-Speed gives power that is instantly available at the rear wheels. Thus, the Selec-O-Speed enables the operator to improve his efficiency, and at the same time the fuel economy of the tractor. The transmission selector also has a neutral and park position, and the tractor engine can be started only with the transmission in "park." When the engine is not running, the transmission automatically goes into park with the wheels locked. The brakes never need to be set with this transmission. In some models of Select-O-Speed Ford tractors, a two-speed PTO is available, providing the two ASAE standard speeds of 540 rpm or 1000 rpm. Selection of PTO speed is by a lever on the side of the transmission housing. Write Tractor and Implement Div., Ford Motor Co., Birmingham, Mich., or circle **No. 4-17.**

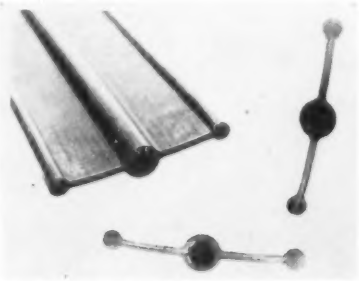
Heavy Duty Line Marker

Line marker from Unimasco is propelled like an automobile

A new Model 9000 heavy duty line marker has been developed by Unimasco, which has the versatility of small machines with the capabilities of large truck mounted units. Available in varying capacities from 10 to 120 gals., this machine is propelled like an automobile and has forward and reverse gears. It is capable of painting from 3 to 6 mph and of operating from one to three spray guns simultaneously. Equipped with all the many features necessary for efficient operation of line marking equipment, it is also capable of painting one or two colors. The spray guns are air actuated and large fluid openings prevent plugging, even with premix compound or other thick bodied traffic paints. The machine can be equipped with Unimasco's new style bead dispenser. These bead dispensers are easily adjustable from the top to regulate the flow of beads from 1 to 10 mph. The Model 9000 with transmission is particularly advantageous for city and county road work. Further details from Unimasco, Incorporated, 426 W. Redondo Beach Blvd., Gardena, Calif., or circle **No. 4-19** on the reply card.

Rubber Waterstop Provides Absolute Watertightness

Presstite-Keystone has announced a new rubber waterstop known as "Aquastop." It has been engineered in both material and design to withstand the contraction, expansion and shearing movements of modern concrete construction. It is able to resist distortion during installation and its flexibility and elasticity virtually eliminates the fatigue problems. It is available in several standard sizes in each of flat dumbbell, split-dumbbell, centerbulb and split-centerbulb types. Also available are a full selection of molded accessories, such as tees, ells, crosses and unions. It has been used successfully in dam construction, bridges and waterworks—in fact, wherever permanent control of water under hydrostatic pressure has been indicated. For more details write the Presstite-Keystone Engineering Products Co., 39th and Chouteau Aves., St. Louis 10, Mo., or circle **No. 4-18** on the reply card.



Several standard sizes are available

Shoulder Spreader

The Model U-500 shoulder spreader, announced by ULMac Equipment, attaches quickly and easily to any Caterpillar No. 12 or 112 motor grader. Spreads to 12 ft. can be made easily and accurately with any spreadable material including hot mix. New curved blade for "live rolling action" mixes and rolls ma-

terial out, minimizing segregation and reducing side draft. The blade is made up in three sections, allowing full variation of spread width to 12 ft. and depth of spreads can be adjusted from 6 ins. above to 18 ins. below pavement level. Positive manual screw-type depth control adjustment eliminates blade creeping and provides precise and simple depth control. Four-wheel suspension with solid rubber tires provides rigid support and stability. All wheels are adjustable, permitting the machine height from the pavement to be varied. Conveyor height can be matched to dump truck gate heights for rapid material movement. The 9-ft. dump hopper accommodates the largest dump trucks and material is dropped directly onto the 36-in. wide, high speed conveyor. Complete information and specifications from ULMac Equipment Co., Inc., El Paso, Ill., or circle **No. 4-20** on the reply card.

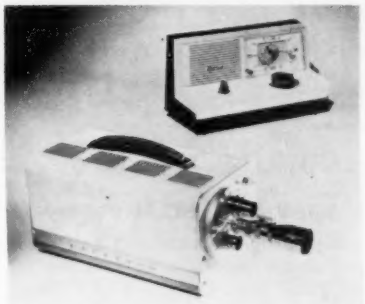
Heavy-Duty Rotary Cutters

Heavy-duty rotary cutters for land-clearing, mulching and right-of-way maintenance are now made by W. F. Covington Planter Co. Exclusive design-feature is a 70-lb. shielded flywheel which not only delivers a steady flow of power to the blades but also enables the cutter to ride easily over obstacles with no interruption of cutting action. The high-speed flywheel action transmits power to the swinging blades with minimum vibration, thus lessening wear and tear on the tractor. Models are available for Jeeps and both drawbar and 3-point lift type tractors. For complete data write W. F. Covington Planter Co., Dothan, Ala., or circle **No. 4-21** on the reply card.

Portable Rotary Diazo

A small portable rotary diazo white print machine known as the Satellite, is announced by Grico, Inc. It measures 44 x 5 x 5 ins., weighs less than 30 lbs. and can be wall-mounted or placed on a small desk or table. The Satellite produces white prints of any length and through 30 ins. in width from any translucent original. The standard fluorescent tube, especially adapted for white printing, insures the intense light needed for quality prints. One convenient front dial with selective speed variations permits exact exposures and a reversal control provides for emergency return. The machine is priced at $199. For further information write to Grico, Inc., 1279 Munroe Falls Ave., Cuyahoga Falls, O., or circle **No. 4-22** on the reply card.

Closed-Circuit TV Unit



15-pound Sylvania camera is shown above in comparison with a clock radio

Sylvania announces a closed-circuit television system designed and priced to stimulate greater use of the medium. The camera in the system will be a vidicon-type weighing 15 lbs. It will require no special lighting and will transmit an image on channels 2 through 6 to any standard, home-type receiver. The camera has a turret mount for three different lenses but may be sold with one, two, or three lenses as required. For complete information write Sylvania Electric Products Inc., 1740 Broadway, New York 19, N. Y., or circle **No. 4-23** on the reply card.

Carrying Case For Builders' Transits and Levels

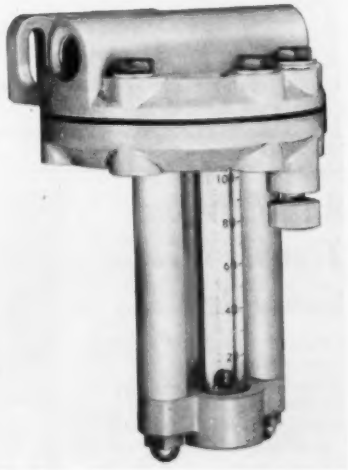
A new lightweight, heavy duty plastic carrying case for its builders' levels and transit levels is introduced by Keuffel & Esser. The steel grey container is virtually impervious to the roughest knocks and outdoor exposure. Accidental opening of the case is eliminated by a positive-locking outer clasp while inside instruments screw securely to a metal plate fixed to the bottom section of the case. For more information write Keuffel & Esser Co., Hoboken, N. J., or circle **No. 4-24** on the reply card.

Plastic carrying case has a soft web strap and no sharp edges or corners

Applicator for Emulsified Asphalt and Tar Seal Coat Materials

A new model applicator is announced by the Higbee-Reichard Corp. for automatically applying such materials as Jennite J-16, Walk-Top, Tarcote, MecoBlack Magic and many other surface seal materials designed to preserve asphalt pavement. The applicator spreads a 4-foot wide strip of material and travels at the rate of approximately 150 fpm. Also a Drum Tipper for pouring seal coat materials from the metal drums into the applicator for mixing is available. When these two pieces of equipment are used together they fully mechanize the seal coat job. For more data write Higbee-Reichard Corp., 947 Newport, St. Louis 19, Mo., or check **No. 4-25** on the reply card.

Liquid Chemical Feeder Operates at Low Flow Rates



Fischer & Porter has introduced a new liquid chemical feeder, known as the Micro-H, that accurately meters, regulates and feeds liquid chemicals continuously at extremely low flow rates from 0.1 to 4.0 gpd into a liquid stream. Semi-automatic, the unit features a built-in ejector, a corrosion-proof plastic body, and a porous stone to feed the chemical. The liquid chemical must be free of suspended solids and should possess sufficient transparency to permit the scale to be seen. It is excellent for hypochlorination of swimming pools. Another unit, the Super-H, feeds liquid chemicals at flow rates from 1.0 to 500 gpd. For more information write Fischer & Porter Co., 27 Jacksonville Road, Hatboro, Pa., or circle **No. 4-26** on the reply card.

NOW

you can **Read** that meter in a pit under water!

with

ViSi-METER

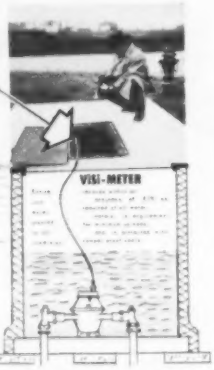
ELIMINATE THE EXPENSE OF PUMPING OUT WATER JUST TO *Get a Reading!*

ELIMINATE NECESSITY OF READER CLIMBING DOWN INTO PIT

✓ 7 DIGIT Industrial register

✓ Register readable at eight feet or more

✓ Installation in many cities PROVEN SATISFACTION



Adaptable to any kind of meter or pit conditions. Operation not interrupted even if unit is covered with ice.

DOES NOT FOG

- YEARS OF CONTINUOUS SERVICE WITHOUT MAINTENANCE
- PERMANENT LUBRICATION IN CABLE (SILICONE BASE TYPE)
- CAN BE INSTALLED IN TWENTY MINUTES BY TWO MEN NOT HIGHLY SKILLED
- GUARANTEED CORROSION FREE
- ENTIRE UNIT EASILY BROUGHT INTO SHOP FOR TESTING WITH METER
- NO SPECIAL TOOLS REQUIRED FOR INSTALLATION. MASONRY BIT AND HAND DRILL

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Anti-Freezing! Trouble-Free! Guaranteed!

- *Rugged brass and bronze construction;*
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- *Non-pollutable from any underground source;*
- *Foot-operation saves on water waste;*
- *Washer-change is about only maintenance needed.*

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Cincinnati 2, Ohio

FOOT-BUTTON ANTI-FREEZING OUTDOOR DRINKING FOUNTAIN

MURDOCK

OUTDOOR DRINKING FOUNTAINS

—

HYDRANTS

—

STREET WASHERS

ANTI-FREEZING COMPRESSION HYDRANT

SELF CLOSING ANTI-FREEZING HYDRANT

Curb machine is operated by two men

Self-Propelled Curb Builder

The new Miller MC-500 extruded curb machine has built-in maneuverability with four bolts providing a fast, easy interchange of the compaction chamber from right to left for laying curb from either side at from 2500 to 3000 ft. per day. New centrifugal clutch and kick-out torque bar provide exclusive safety features, saving damage to screw and mechanism. The machine with its 8.5 hp motor, is lightweight and is operated by 2 men. Curb forms are available in a wide range of specification shapes for both asphalt and concrete extrusion. More details from Miller Spreader Corp., 4020 Simon Rd., Youngstown, 12, Ohio, or circle **No. 4-27** on card.

Pyrex Brand Glass Refractors for Street Lighting

Street lighting refractors of heat resistant Pyrex brand glass are now available from Corning Glass. The refractors are being made for both General Electric and Westinghouse units. The GE #500 refractor for its "R" IES Type III incandescent optical assembly is now being made of the high-strength, low expansion borosilicate glass. The refractor is being used with lamps up to 620 watt, 10,000 lumen size. Two different Pyrex refractors are being made

Refractor made by Corning Glass Works installed with the Westinghouse OV-35

Cypak Static Control Parks Cars

A Cypak control system is now serving as a parking attendant. A magnetic coil beneath the road senses the presence of the car and causes the ticket dispenser to stamp the date and time on a ticket. The driver has only to accept the ticket from the machine. Then the system permits the car to enter by raising the parking lot gate and the gate closes when the car passes over a second magnetic coil. The Cypak system can also adapt itself to a steady stream of incoming cars. For instance, if one driver is passing through the gate just as a second driver receives his ticket, the system leaves the gate up or, if the gate has started to close, it causes the gate to stop immediately and then to rise. For more details write Westinghouse Electric Corp., Box 2278, Pittsburgh 30, Penna., or circle **No. 4-28** on the reply card.

for Westinghouse's OV-35 series. One is for the clear mercury lamps in the 700 and 1000 watt sizes. The other is for color corrected mercury lamps in the 400, 700, and 1000 watt sizes. For complete details write Corning Glass Works, Corning, N. Y., or circle **No. 4-29** on the reply card.

Portable Batching Plants

The introduction of a 6-yd. portable batching plant having a capacity of 40 yds. per hour has been announced by Aeroil. The plant features the use of Man-Ten abrasion resistant steel in the hopper. Beam Scales with over/under indicator are furnished as standard equipment. The conveyor is 24 ins. wide and has a normal discharge height of 12 ft. The plant is 4-wheel mounted for portability and is available in either gas engine or electric motor drive. Further details from Aeroil Products Company, Inc., 17 Wesley St., South Hackensack, N. J., or circle **No. 4-30** on the reply card.

Snow Removal Equipment for IHC Utility Tractors

Wausau V-type snow plow for the International 240 utility tractor clears a path six feet six inches in width

A wide selection of snow removal equipment is now available to match International Harvester's new line of utility tractors. Consisting of snow plows, blades, buckets and brooms, the equipment is designed for heavy-duty clearance of streets, parking lanes and off-street parking lots. Smaller leveling and grader blades for walks and drives also are available for use on Farmall Cub and International Cub Lo-Boy models. Snow equipment includes Wausau V-type, straight blade and reversible, trip-blade plows. Bucket sizes are ¾, 1 and 1½ cu. yds. Rotary brooms are available for all cub and utility models. For full details write Consumer Relations Dept., International Harvester Co., 180 North Michigan Ave., Chicago 1, Ill., or circle **No. 4-31** on the reply card.

CLASSIFIED ADVERTISING AND JOB OPPORTUNITIES

WATER SUPERINTENDENT

The Village of La Grange, Illinois, is seeking applications for the position of Water Superintendent. Will have charge of complete water works system, including treatment and distribution. 3 MGD plant. Lime-soda ash-zeolite softening process. Salary open. Attractive fringe benefits. Apply submitting resumé of education and experience to:

Robert E. Meyer
Village Manager
La Grange, Illinois

Superintendent—Water and Sewers

Graduate sanitary engineer wanted with minimum 3 years experience in an andministrative capacity of water filtration plant and water system operations and/or sewage disposal systems. Salary range $6,408 to $7,356. Eligibility for Professional Engineers license preferred but not required.

Send resume and application to:

City Administrator
City Hall
Batavia, New York

SANITARY ENGINEERS WANTED

Leading Midwestern manufacturer of Sewage and Industrial Waste Treatment Equipment and Building Pumps needs Graduate Sanitary Engineers to train for either inside or field positions. No experience required. Excellent opportunity for permanent position with well established growing concern. Resume required.

Write to:
Box 2-2C
Care of Public Works Magazine

CITY ENGINEER WANTED

Registered engineer with qualifying experience in supervision of sewage treatment plant, storm and sanitary sewers, streets and sidewalk design and building code. Salary open as to qualifications.

Write to:
City Clerk
City Hall
Algona, Iowa

Vibrating Equipment for Compaction

Reputed European manufacturer wants to cooperate with U. S. manufacturer, preferably of road construction equipment for selling vibrating equipment, rollers, plates, etc. with option for an assembling and manufacturing license.

Address Box 4-1 care of Public Works Magazine

IF YOU WANT TO:

- **Sell Used Equipment**
- **Hire Personnel**
- **Obtain Employment**
- **Make Announcements**

Use Our Classified Section For Quick Results

Write to:
Classified Ad Dept.
Care of this Magazine

ASSOCIATE TRAFFIC ENGINEER
Salary Range $485 to $590

Graduate engineer with experience in traffic engineering wanted to expand traffic control program for city. Write for information and application to CITY OF WICHITA, Room 407 City Building, Wichita, Kansas.

PROFESSIONAL OPPORTUNITY

The Department of Sanitary Engineering of the District of Columbia is accepting applications for the positions of Sewage Treatment Plant Shift Superintendents.

Desired qualifications include college degree in sanitary or civil engineering and previous experience in sewage treatment plant operation. The starting salaries for these positions are $4,490 to $7,510, depending on experience.

This is a Civil Service position as a Shift Superintendent in a high-rate activated sludge treatment plant of a design capacity of 290 mgd. Benefits include paid annual leave and sick leave, group insurance, retirement and other employee benefits.

Those interested may send a complete summary of education, experience and personal data to Mr. Hugh A. Schreiber, Superintendent, D. C. Sewage Treatment Plant, 5000 Overlook Avenue, S. W. Washington 24, D. C.

SPECIAL REPRINT OFFER!

Following three reprints are being offered at special reduced prices.

- **The Use of Photometric Instruments for Colorimetric Analysis of Water and Wastes.**
- **Nomographic Solutions for the Design of Trickling Filters and Sedimentation Tanks.**
- **Actinomycetes May Cause Tastes and Odors in Water Supplies**

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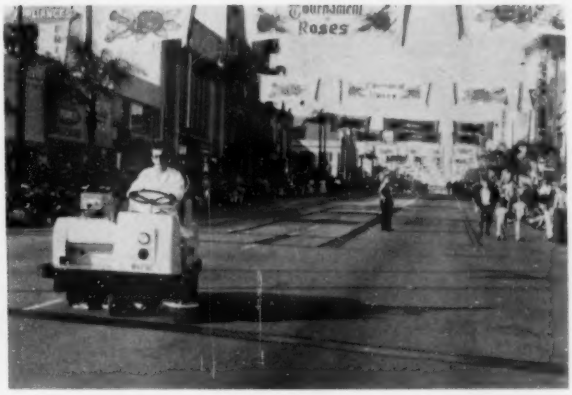
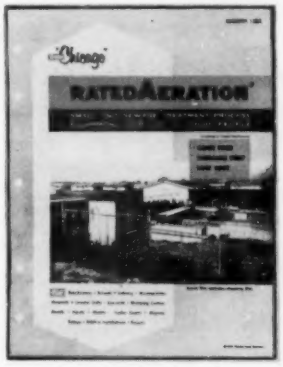
WORTH SEEING

The number of Hi-Way spreaders for ice control owned by their state can no longer be counted on any Iowan's fingers. The 68th Model "E" spreader, a product of Highway Equipment Company, Cedar Rapids, was delivered recently.



If not actually a part of the Tournament of Roses parade at Pasadena last New Year's, this Wayne 706 power sweeper at least led the way. Here it proudly sweeps an intersection only minutes before the spectacular parade started.

Douglas Amundson, Advertising Manager of Chicago Pump Company, received special honors at the National Association of Home Builders Convention held in Chicago last January. His "presentation of useable ideas for sub-dividers" was in the form of their Rated Aeration Bulletin 135-A, which was voted the top award, exceptional merit, in Class 5 of the NAHB Ideas for Home Builders Contest. This bulletin also won honorable mention in Class 1 for its "assistance to builders in selecting materials or products." A description of the prize-winning bulletin will be found in the Readers' Service section of this issue, listing No. 568.



Giving a close look at their new production, a 15-minute sound and color film showing the making and installation of asbestos-cement pipe, are Keasbey & Mattison's Advertising Manager J. C. Affleck and Sales Manager James Reichel (left). Copies of the film can be obtained for group showings upon request to K & M at Ambler, Pa., headquarters.

If you ever took off from or landed at the present Miami International Airport, this artist's rendering of the coming new terminal will give you a lift. Costing $30 million, it will have everything: 6,000-car parking lot, covered walkways, hotel, six "fingers" comprising 74 gate positions capable of loading and unloading an equal number of aircraft simultaneously. Even provisions for getting your baggage the same day you arrive will be included! (At least you can hope)

STREET and PARK

Type 48-F

Refuse Receptacles

TARCO receptacles are smooth, ruggedly built . . . welded heavy gauge steel. Locking removable hood. Baked enamel finish. Heavy burlap inner-liners available. **FEATURE:** Two self-closing **doors hang vertical** . . . . straight down so NO rain or snow can get inside.

TARRANT MFG. CO.
28 Jumel St.
Saratoga Springs, N.Y.

When this Nameplate goes into place . . .

YOU KNOW YOU HAVE *the Best*

ROBERTS FILTER MANUFACTURING CO.

640 COLUMBIA AVE.
DARBY, PA.

by Arthur K. Akers

★ MORTON SALT CO. names Robert L. Young as industrial water softening specialist to work with water softening manufacturers and consulting engineers.

★ LAYNE & BOWLER, Inc., Memphis, elevates C. E. Ponkey from executive vice president to president, succeeding W. H. Reeves who after 52 years lightens his personal load by moving to a consultant capacity as a vice president.

Mr. Ponkey

Mr. Billings

★ CLAYTON H. BILLINGS, associate editor of PUBLIC WORKS, will serve on two important Federation of Sewage and Industrial Wastes Associations committees, Public Relations and Resolutions.

★ T. L. JOHNSON succeeds W. P. (Pete) Cox as vice president—sales of McWane Cast Iron Pipe Co., Birmingham, Ala. Mr. Johnson has for the past 25 years been sales manager, Pacific States Cast Iron Pipe Co., Provo, Utah, a McWane affiliate. Pete Cox announces plans to "go fishin'," in his well-earned retirement.

★ HYDRA-NUMATIC SALES CO., Hackensack, N. J., now handles sales in New Jersey-New York areas for DeZurik Corporation, water and sewage treatment equipment. Jack Williamson, formerly with Ralph B. Carter Co., has joined Hydra-Numatic.

★ WARNER & SWASEY CO. has divided the nation into eight basic territories to handle combined Gradall and Hopto lines of earth-handling equipment, with I. T. White as manager of sales, Construction Equipment Division.

★ DEMPSTER BROTHERS, Knoxville, Tenn., announce a new 15-minute color-sound film with music, "The New Era of Refuse Collection." It combines history, present practices, prophecy, and solutions to various problems. A print may be had from Dept. F-18, Dempster Brothers, Knoxville 17, Tenn. Give date it is desired.

★ 127 MONTGOMERY ST., San Francisco, is where our Bay area friends will find Union Metal Mfg. Company's new sales office, with Charles Strom as manager.

★ D. E. BRUBAKER is appointed advertising and sales promotion manager, A. Y. McDonald Mfg. Co., Dubuque, Iowa, water works brass goods.

★ WILLIAM E. DICKINSON moves up to vice president of the Calcium Chloride Institute, Washington. Bill has been with the Institute for 13 years, and is active in Highway Research and American Road Builders committee affairs. He will continue as chief engineer for the Institute.

Mr. Dickinson

★ BELOW, appears the group who are out to step up operations and sales of "Quick Way" Truck Shovel

Co., Denver, in the coming year. Gilbert S. Rigdon, new executive vice president, is in the center.

★ A PUZZLED traveler in the Kentucky mountains saw a woman dousing two somnolent natives with water. "Keeps the flies off'n'em," she explained.

CB&I steel structures

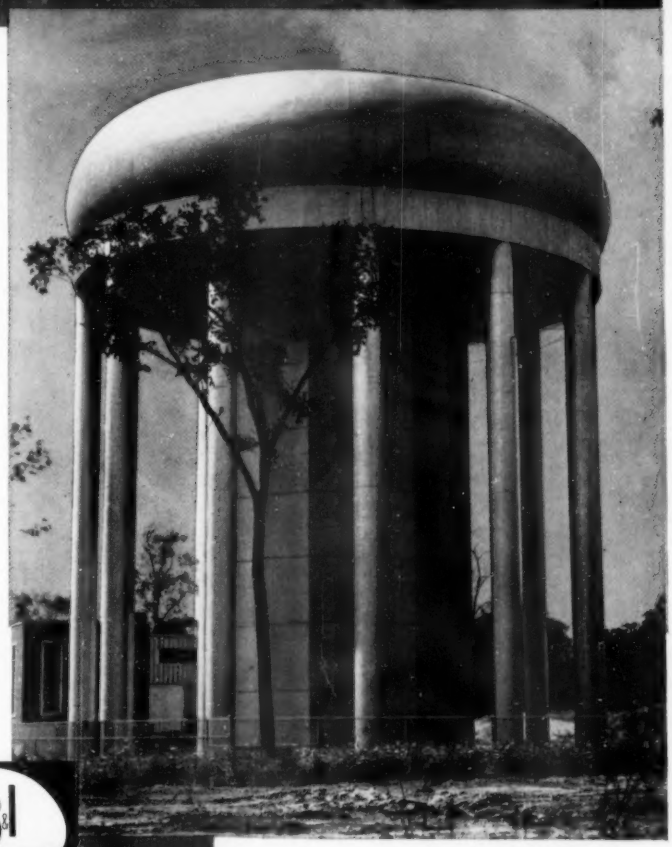
boost Michigan County's water reserves to 13,000,000 gallons

These two CB&I-built, all welded, structures share the responsibility with two 1,000,000-gallon Horton® radial-cone elevated tanks for providing Southeastern Oakland (Michigan) County with 13,000,000 gallons of dependable water storage.

In Oakland County, as in water-wise municipalities all over the country, CB&I water storage structures have already become an *integral part* of water commission or water department planning for increasing water needs.

Whether you require as little as 50,000 or 10,000,000 gallons or more of storage, you too can rely on CB&I's 67 years of *craftsmanship in steel* . . . to provide *your* community with assurance of *proven* engineering, fabricating, erection and trouble-free service life. In tanks and towers, as in any municipal service—it's proof of past performance that counts. And . . .

YOU CAN BE *SURE* WITH STEEL
. . . AND *CERTAIN* WITH CB&I



top: Horton cone-roof reservoir meets increased water needs of Southeastern Oakland (Michigan) County with 10,000,000-gallon water storage capacity.

bottom: Graceful Hortonspheroidal® tank minimizes pressure variations and meets peak load demands with gravity flow from 1,000,000-gallon elevated reserve.

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston
New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • South Pasadena • Tulsa
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY, GREENVILLE, PA. and NEW CASTLE, DEL.

M44C

the V-notch

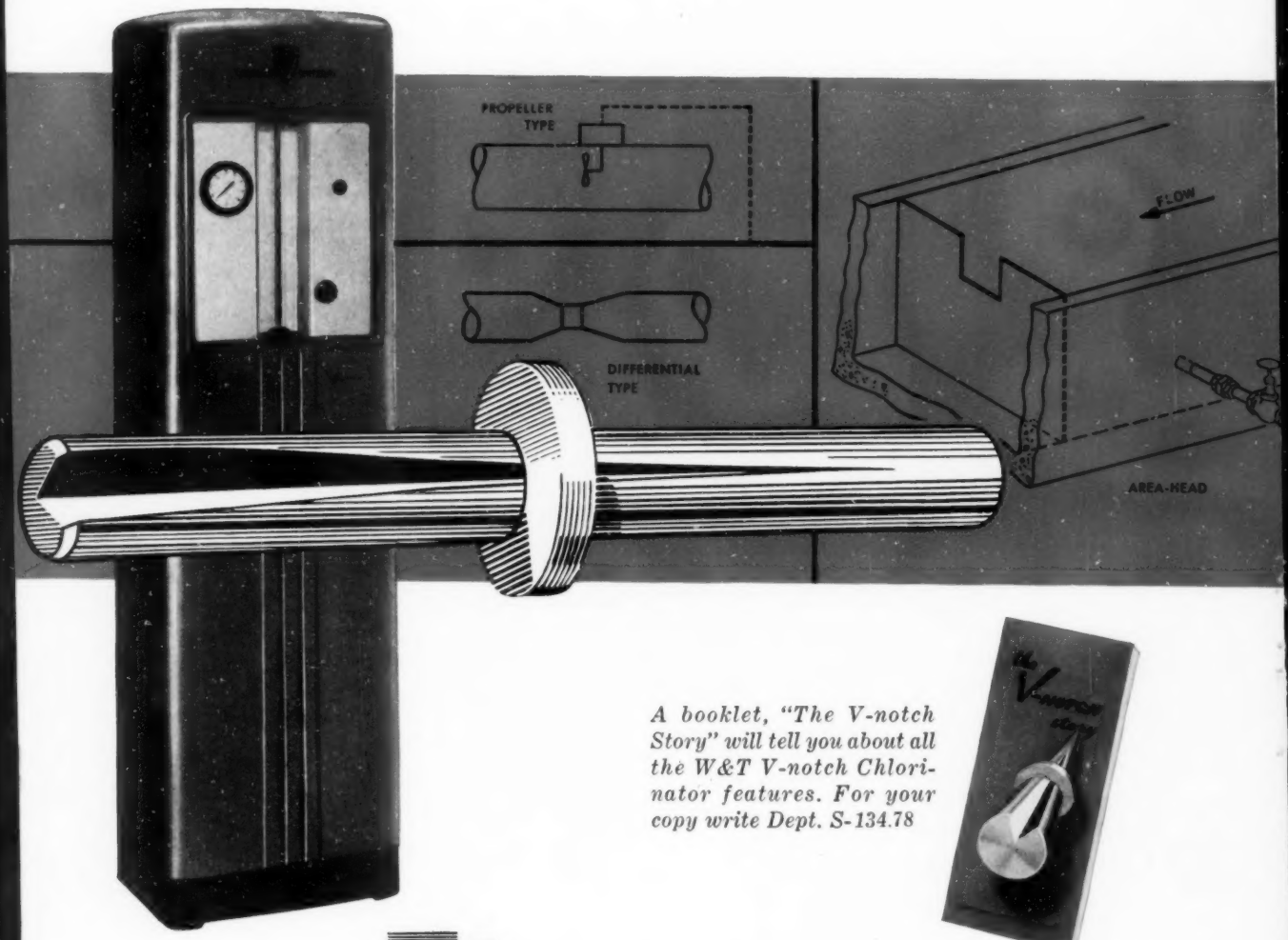
ready and waiting for your signal

Lots of jobs are done better automatically. Changing chlorine feed rate is now one of them. With the V-notch... the straight line metering action of the plug through the ring makes automation simple.

Merely by adding, not adapting, a W&T V-notch Chlorinator can give you any degree of automatic control you want—step rate, start-stop, program, proportional, even residual control.

With a V-notch Chlorinator any signal from any primary metering device can control chlorine feed. So anyone can afford automation.

And, of course, the right plastics make the whole chlorinator chlorine-proof.



A booklet, "The V-notch Story" will tell you about all the W&T V-notch Chlorinator features. For your copy write Dept. S-134.78

WALLACE & TIERNAN INCORPORATED

25 MAIN STREET, BELLEVILLE 9, NEW JERSEY